Texas A&M AgriLife Extension

ESC-042
6/16

Bermudagrass Lawn Management Calendar

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Bermudagrass

Scientific Name: *Cynodon dactylon* L. Pers; *Cynodon dactylon* (L.) Pers × *Cynodon transvaalensis* Burtt Davy

Strengths: Drought tolerance, heat tolerance, deep rooting potential, durability, good recuperative potential, salinity tolerance, rapid establishment rate, and low disease potential.

Weaknesses: Does not tolerate shade well, requires frequent mowing, moderate to high fertilization requirement.

Description: Bermudagrass is a warm-season, fine-textured turfgrass that spreads stems laterally below-ground by rhizomes and above ground by stolons. It is a drought-hardy, durable, and versatile turfgrass. It establishes relatively quickly from seed or sprigs and has superior traffic tolerance and rapid recuperative potential. These attributes, combined with its tolerance for low mowing heights, make it ideal for golf courses and athletic fields as well as other heavily trafficked areas. It is also one of the most well-adapted turfgrass species for use in Texas home lawns (Figure 1).

Many varieties of bermudagrass are available—it can be purchased as seed, sprigs, or sod (https://aggieturf.tamu.edu/texas-turfgrasses/bermudagrass/). It is, however, important to note the distinction between 'common' and 'hybrid' varieties.

Common bermudagrass (*Cynodon dactylon*) varieties often have coarse leaf texture and are light green compared to hybrid varieties. However, breeding efforts have significantly improved the appearance of common bermudagrasses. Some of these improved varieties have finer leaf texture, darker color, and greater density. These are most often planted as seed, but some (e.g. Princess) are also available as sod.

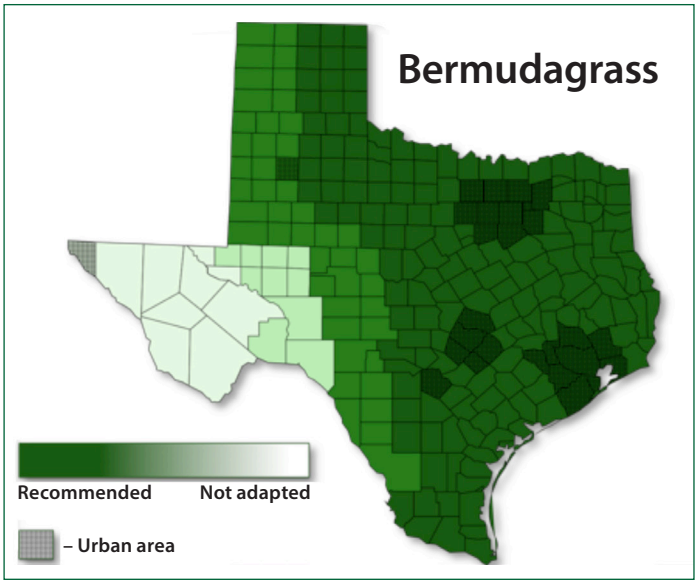

Figure 1. Areas adapted to Bermudagrass

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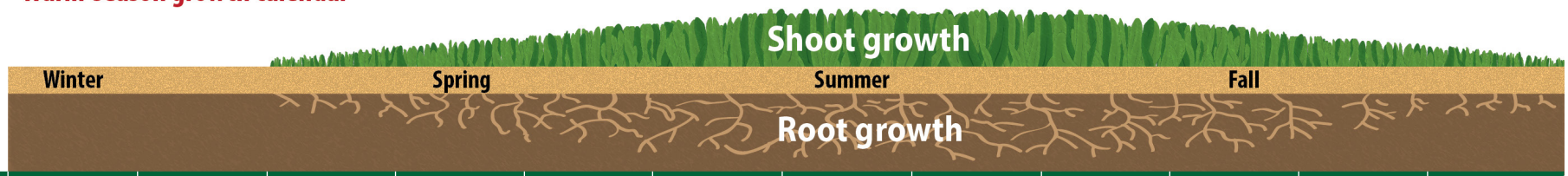
Bermudagrass Home Lawn Management Calendar

Warm-season growth calendar



	January	February	March	April	May	June	July	August	September	October	November	December
Mowing	Mow if necessary to prevent winter annual weeds from flowering (p. 6)		Mow at 1-2" height weekly, or as frequently as required to prevent scalping. Observe the 1/3rd rule by never removing any more than 1/3rd of the leaf tissue at any one time (p. 3)								Mow if necessary to prevent winter annual weeds from flowering (p. 6)	
Irrigation	Turn off irrigation during winter months when temperatures are cool and the lawn is not actively growing (dormant) (p. 4)		Conduct an irrigation audit before turning on irrigation during the spring and summer (p. 4)		Irrigate only when necessary to prevent the onset of drought stress or to replace at least 60% of ET. Turn off the system during rainy periods or during early spring and late fall where ET rates are lower and natural rainfall is more likely to meet the lawn's needs. (p. 4)						Turn off irrigation during winter when temperatures are cool and the lawn is not actively growing (dormant) (p. 4)	
Fertilization				Do not make 1st fertilizer application until the lawn is actively growing and has been mowed 2 to 3 times (p. 6)		Apply 0.5 to 1 lb of N/1,000 ft² for a total of 1 to 4 applications during the growing season. Space fertilizer applications 4 to 8 weeks apart using a combination of quick and slow-release nitrogen (N). Apply other nutrients based on soil test results. Do not apply fertilizer during to drought stressed grass. (p. 5)					
Weed Control		Apply pre-emergence herbicides for crabgrass, goosegrass, and other summer annual weeds. Apply post-emergence herbicides for cool-season perennial weeds or winter annual weeds. Use caution during spring green-up as turfgrass injury may occur. (p. 6)			Apply post-emergence herbicides for summer annual weeds such as crabgrass, purslane, spurge, etc. or warm-season perennial weeds such as Virginia buttonweed before the onset of summer drought stress (p. 8)				Apply pre-emergence herbicides for annual bluegrass, chickweed, henbit, and other winter annual weeds. (p. 9)		Apply post-emergence herbicides for winter annuals such as annual bluegrass, chickweed, henbit, etc. or for cool-season perennial weeds. (p. 9)	
Insect Control				Scout for fire ants and apply insecticides if necessary using a combination of broadcasts, baits, and individual mound treatments. (p. 10)								
						Apply preventative grub products if necessary (p. 10)		Apply curative control for white grubs if necessary. Scout for fall armyworms. (p. 10)				
Disease Control				Scout for bermudagrass decline (aka, take-all root rot)								
				Scout for spring dead spot. It is not appropriate to apply fungicides for this disease at this time (fall applications are ideal) (p. 10)					Scout for large patch and apply fungicides before patches develop. Apply fungicides in areas with a history of spring dead spot. (p. 10)			
Aeration				Aerate if possible to relieve soil compaction, especially in newer lawns with limited organic matter accumulation or in lawns that receive moderate to heavy use. Aeration is best performed when there is adequate soil moisture so that the aeration tines remove a soil core effectively.								

This calendar is intended only as a guide and practices herein may vary based on site and region.
Visit http://AggieTurf.tamu.edu for more information on turfgrass management practices, weed identification, and pest control.

Hybrid bermudagrass varieties are typically crosses between common bermudagrass and African bermudagrass (*Cynodon dactylon* × *Cynodon transvaalensis*). They are often more attractive due to their fine leaf texture, greater density, and dark green color. These hybrid varieties are typically preferred for golf courses, athletic fields, and some home lawns. Seed from these crosses, however, is often sterile, so hybrid bermudagrass varieties must be planted as sod or sprigs.

Hybrid bermudagrasses also differ from common varieties in that they require more fertility, mowing, and thatch management for maximum performance. It is important to consider how much management you can provide before selecting a bermudagrass variety.

While bermudagrass tolerates drought, traffic, pests, and other stresses very well, it is not very shade tolerant. Bermudagrass may struggle in moderate to dense shade, so you should consider species such as St. Augustinegrass or zoysiagrass for areas where shade is a concern. Among bermudagrasses, Celebration and TifGrand are two varieties that have improved shade tolerance and may perform adequately in moderate shade.

Mowing

Mowing is one of the most important cultural practices for managing turfgrasses. It encourages turfgrasses to grow laterally, and frequent mowing can result in improved density. If turfgrasses are mowed too tall, or not frequently enough, they may lose density. This happens because turfgrass leaves grow upward to compete for light with neighboring plants. Mowing too low removes too much leaf tissue, and will cause inadequate density, root development, and a reduction in overall turfgrass health. Returning clippings to the lawn is a great way to recycle nutrients (see Fertilization).

The recommended mowing height for bermudagrass home lawns is 1 to 2 inches using a rotary mower. Hybrid varieties such as those used on golf courses and athletic fields can be mowed to less than 1 inch. However, this typically requires multiple weekly mowings using a reel mower. For bermudagrass home lawns, mowing be done weekly during the growing season, or as often as necessary to prevent scalping. The general rule when mowing turfgrass is to never remove more than ⅓ of the leaf tissue at once—this is referred to as the "one-third rule." For example, if the lawn is 1 inch tall, then it should be mowed again as soon as it reaches a height of 1.5 inches. Mowing frequency can vary based on season, temperature, rainfall/irrigation, and fertility.

A reliable visual clue is to make sure the lawn does not change from green to brown after mowing. If it does, too

Tips for successful and responsible Bermudagrass management

- Select the appropriate variety
- Mow at the appropriate height and frequency to maintain adequate leaf tissue and turfgrass density
- Conduct an irrigation audit to determine run times and irrigation efficiency
- Irrigate only during the growing season months. Don't irrigate during the late fall, winter, or early spring when bermudagrass is dormant, plant ET rates are low, temperatures are cool, or when rainfall is occurring.
- Conduct a soil test at least every other year to help select a fertilizer with the right nutrient balance.
- When applying nitrogen (N) to lawns, do not exceed 0.5 to 1 lb of N per 1,000 ft^2 at any single application—use combinations of quick and slow release N.
- Always follow label instructions when applying fertilizers, herbicides, insecticides, and fungicides.
- Refer to http://AggieTurf.tamu.edu for more information on turfgrasses and identification tools for common turfgrass weeds and insects.

much green (photosynthetic) leaf tissue has been removed. This puts unnecessary stress on the plant from which it will have to recover—it indicates that the lawn is being mowed too low or not often enough. Remember that green leaf tissue in turfgrasses is where photosynthesis takes place. This part of the grass is what drives the synthesis and accumulation of carbohydrates in the leaves, stems, and roots. Consequently, lawns that are mowed too low or too infrequently have a decreased photosynthetic rate, produce and store fewer carbohydrates and are often less stress tolerant than lawns that are mowed appropriately.

Irrigation

Bermudagrass is one of the most heat and drought tolerant species of turfgrass available in Texas. Where irrigation is not available it can often survive on natural rainfall. However, bermudagrass benefits from appropriate supplemental irrigation. As plants grow, they take in atmospheric carbon dioxide (CO_2) and convert it into carbohydrates through photosynthesis. These carbohydrates are used to produce new leaves, stems, and roots. When plants open microscopic pores (stomata) on the leaf surface to take in CO_2, they release water vapor into the atmosphere. This process is called transpiration—it is what provides the cooling effect from lawns and other plants around homes.

However, when plants enter drought stress, the stomata close to prevent losing excess water. This, in turn, reduces CO_2 intake and growth. When this happens, turfgrasses may wilt, turn brown, and go dormant. Many warm-season turfgrasses are drought adapted and can survive dormancy for long periods. However, their appearance and performance may decline. Summer irrigation can prevent excessive drought stress.

One way to schedule irrigation is by inspecting the turf for wilting leaves and a blue-gray color throughout the lawn. These are good indicators of drought stress. Irrigation can then be used to relieve this stress, and then repeated when drought stress re-occurs. After the first days or weeks of the growing season, it will become apparent how often the irrigation system should be set to prevent drought stress. Scheduling 1 day per week or 2 days per week will depend on factors such as soil type, rooting depth, slope, location, etc.

Another method, which uses water responsibly, is to use evapotranspiration (ET) rates as a reference point for scheduling irrigation. The Texas ET network (http://texaset.tamu.edu) provides evapotranspiration rates throughout the state daily and should be consulted before deciding when to irrigate lawns and other plants. Turfgrasses generally perform well when at least 60 percent of ET is replaced with irrigation or natural rainfall during the growing season.

Figure 2. Irrigation audit being performed in a home lawn

Irrigation audits are vital in determining the length and frequency of waterings. These audits also identify irrigation efficiency, gaps in coverage, etc. One way to perform an audit is to hire a certified landscape irrigation auditor to evaluate your irrigation system (Figure 2). Another way is to perform a 'catch-can test' by placing a series of containers throughout the lawn and setting the irrigation system to run for a predetermined amount of time. You can use Aggie Catch Cans, graduated cylinders, jars, cans, etc., and then use a ruler to measure how much water is in each container. This information will help you determine how to schedule your system. For example, if you catch 0.33 inches of water in 20 minutes, scheduling your system to run for 20 minutes 3 times per week will deliver approximately 1 inch of water per week. For more information, including an instructional video, on how to perform an irrigation audit, visit http://irrigation.tamu.edu/coursematerial.php.

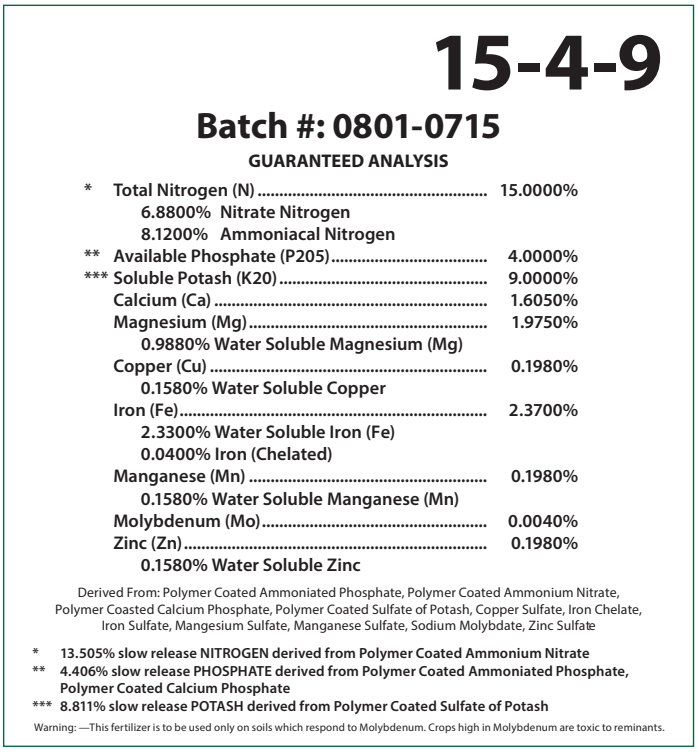
It is important to turn off, or significantly reduce irrigation from late fall to early spring. During this time, warm-season grasses are dormant and cooler temperatures, reduced growth, and natural rainfall, combine to meet their ET needs. Over-irrigating in the spring and fall can also increase the incidence of diseases such as large patch and take-all patch. Exceptions to this reduction include southern parts of Texas where warm-season turfgrasses do not go fully dormant, sandy soils that are well-drained, or newly laid sod.

Fertilization

Turfgrasses require inorganic nutrients for growth. They obtain these mineral nutrients from the soil, air, and water. Many of these nutrients are present in the soil naturally, but their amount and availability vary based on soil pH, chemistry, and the plant's needs. Therefore, it is often important to supplement these nutrients through fertilization.

The most accurate way to determine the nutrient status of soils is through soil testing. Soil can easily be tested by following the instructions on the "Urban and Homeowner Soil Sample Information Form" from the Texas A&M Agrilife Extension Soil, Water, and Forage Testing Laboratory (http://soiltesting.tamu.edu/files/urbansoil.pdf). This form tells when, where, and how to collect soil samples. If the nutrient status of a lawn is found to be deficient, fertilization recommendations will be provided in the soil test results.

Once it has been determined that fertilization is needed, you can select the appropriate fertilizer. This selection is based on the soil test results, whether the turfgrass has high- or low-traffic, whether the soil is sand or clay, the target application rate, and the desired outcome. These factors determine if and how much fertilizer you need to meet plant needs.



15-4-9

Batch #: 0801-0715

GUARANTEED ANALYSIS

*	Total Nitrogen (N)	15.0000%
	6.8800% Nitrate Nitrogen	
	8.1200% Ammoniacal Nitrogen	
**	Available Phosphate (P205)	4.0000%
***	Soluble Potash (K20)	9.0000%
	Calcium (Ca)	1.6050%
	Magnesium (Mg)	1.9750%
	0.9880% Water Soluble Magnesium (Mg)	
	Copper (Cu)	0.1980%
	0.1580% Water Soluble Copper	
	Iron (Fe)	2.3700%
	2.3300% Water Soluble Iron (Fe)	
	0.0400% Iron (Chelated)	
	Manganese (Mn)	0.1980%
	0.1580% Water Soluble Manganese (Mn)	
	Molybdenum (Mo)	0.0040%
	Zinc (Zn)	0.1980%
	0.1580% Water Soluble Zinc	

Derived From: Polymer Coated Ammoniated Phosphate, Polymer Coated Ammonium Nitrate, Polymer Coasted Calcium Phosphate, Polymer Coated Sulfate of Potash, Copper Sulfate, Iron Chelate, Iron Sulfate, Mangesium Sulfate, Manganese Sulfate, Sodium Molybdate, Zinc Sulfate

* 13.505% slow release NITROGEN derived from Polymer Coated Ammonium Nitrate
** 4.406% slow release PHOSPHATE derived from Polymer Coated Ammoniated Phosphate, Polymer Coated Calcium Phosphate
*** 8.811% slow release POTASH derived from Polymer Coated Sulfate of Potash

Warning: —This fertilizer is to be used only on soils which respond to Molybdenum. Crops high in Molybdenum are toxic to reminants.

Figure 3. Fertilizer label example

Fertilizer labels (Figure 3) are required by law to indicate how much of each nutrient is present in the product—the quantity is reported as percent by weight. For example, a fertilizer that contains 15 percent nitrogen (N), 4 percent phosphate (P_2O_5), and 9 percent potash (K_2O) is represented as 15-4-9. Nitrogen (N), phosphorous (P), and potassium (K) are the three macronutrients that turfgrasses need most—they are always presented in this order on the label. It is also common for fertilizer manufacturers to list secondary nutrients such as calcium (Ca), magnesium (Mg), or sulfur (S), or even micronutrients such as iron (Fe), manganese (Mn), boron (B), copper (Cu), zinc (Zn), molybdenum (Mo), or chlorine (Cl). Just as with N, P, and K, applications of secondary nutrients or micronutrients should always be made based on soil test results. With the exception of iron in high pH soils, micronutrients rarely need to be applied to home lawns.

Nitrogen is the mineral plants need in the largest quantity. Regardless of whether nitrogen is applied as plant material, manure, waste by-products, etc. (organic) or as synthetic fertilizers (inorganic), the nitrogen in these products must be converted into inorganic ammonium (NH_4^+) or nitrate (NO_3^-) ions before plants can take them up.

Nitrogen is unique in that it drives turfgrass growth. Over-applying most nutrients will not affect plant growth, but too much nitrogen can stimulate excessive turfgrass growth. This can make a lawn grow rapidly for a few weeks after fertilizing, and cause scalping, accumulation of leaf clippings, or other problems. To avoid these problems you can use slow-release fertilizers that deliver nitrogen into the lawn gradually. When selecting a nitrogen fertilizer, consider the benefits of products that combine quick- and slow-release nitrogen. Quick release sources of nitrogen such as urea, ammonium nitrate, ammonium sulfate, and others, provide immediate short-term plant growth. Slow-release nitrogen sources such as sulfur coated urea (SCU), polymer coated urea (PCU), urea-formaldehyde, methylene urea, and organic products provide a much slower, long-term response. A fertilizer that combines these sources can help lawns by supplying immediate growth and a long-term response as well. Information on the amount of slow- and quick-release nitrogen can be found on the fertilizer label (Figure 3).

Once you select an appropriate fertilizer, you must determine the appropriate application rate. Fertilizer nutrients are typically applied at rates of 0.5 to 1.0 lb of nutrient per 1,000 ft^2. To calculate how much fertilizer to apply based

on a specific fertilizer analysis and application rate, do the following:

1) Measure the area of the lawn in square feet (Area)
2) Select the rate at which you are applying the product (Application Rate)
3) Determine the analysis of the fertilizer (Analysis)

Multiply these three values together to determine how much total fertilizer to apply.

Example: A homeowner wants to apply 1.0 lb of nitrogen per 1,000 ft² to a 4,500 ft² lawn and is purchasing fertilizer with a 15-4-9 analysis.

$$\underset{4{,}500\ ft^2}{Area} \times \underset{\frac{1\ lb\ of\ nitrogen}{1{,}000\ ft^2}}{Rate} \times \underset{\frac{1\ lb\ of\ fertilizer}{0.15\ lbs\ of\ nitrogen}}{Analysis} = \underset{30\ lbs\ of\ 15\text{-}4\text{-}9}{Total\ amount}$$

This equation can be customized to different situations by changing the area, application rate, or fertilizer analysis and re-calculating.

In lieu of this calculation, many fertilizer products are designed specifically for lawns and will often indicate how much area they will cover. For example, the product label may state "covers 4,000 square feet" on the bag. When applied following these directions, it usually results in an application of 0.8 to 1.0 pound of nitrogen per 1000 square feet. This is a simple way for manufacturers to help customers determine how much fertilizer to buy.

Knowing your soil test results and calculating how much fertilizer to use will allow you to develop a nutrient management plan that meets your lawn's needs without exceeding them. A typical nutrient management plan for a bermudagrass home lawn in Texas can range from 1 to 4 applications per year using 0.5 to 1 pound of nitrogen per 1,000 square feet per application during the growing season.

Fertilization may not be as necessary in older lawns. Lawns with established cover and well-developed root systems can build up an adequate supply of organic nitrogen in the soil. This is because turfgrasses recycle nutrients back into the soil as plant matter (clippings, roots, etc.). Grass clippings that return to the lawn through mowing are broken down by soil microorganisms and can be used by the plant for future growth.

Do not apply nutrients to bermudagrass lawns before full green-up in the spring. It is also not appropriate to fertilize during hot, dry periods in the late summer when moisture may be limiting, or in the late fall and winter when lawns are, or are becoming, dormant. Nutrients are most efficiently assimilated by lawns when they are actively growing and not under heat or drought stress. Do not apply fertilizer if heavy rain is expected within the following 24 hours. Instead, apply irrigation if possible (less than .25 inches) to help move the fertilizer into the soil. It is also important to sweep or blow stray fertilizer granules off hardscapes back into the lawn.

Weed control

A dense, healthy lawn is the best defense against weeds. Proper variety selection and management practices are vital to preventing or limiting weed infestations. For example, using mowing heights at the higher end of the recommended range can significantly reduce infestations of weeds such as crabgrass, while over-irrigating can make weeds such as nutsedge more problematic. Too much shade can cause turfgrass to lose density and allow shade tolerant weeds to thrive. When weeds are present, it is important to identify and address the cause of thinning turfgrass before treating for weeds. To control weeds in home lawns, please consider the following:

1) Determine whether it is a grassy weed, broadleaf weed, or sedge.

Broadleaf weeds such as clovers (*Trifolium* and *Medicago* sp) and dandelion (*Taraxacum officinale*) usually have net-like leaf veins though leaf shapes vary widely (Figure 4). Grassy weeds such as crabgrass (*Digitaria* sp) and dallisgrass (*Paspalum dilatatum*) have parallel leaf veins and long, slender leaves. Sedges (*Cyperus* spp) such as yellow nutsedge (aka nutgrass) look similar to grasses but have a triangular stem. Identification tools and an image gallery of over 100 common Texas weeds are available at: https://aggieturf.tamu.edu/turfgrass-weeds/.

2) Determine the weed's life cycle.

Summer annual weeds such as crabgrass and spurge (*Chamaesyce* sp) germinate in the spring, grow for several months, and then flower, set seed, and die in the fall. Conversely, winter annual weeds such as henbit (*Laminum amplexicaule*) and rescuegrass (*Bromus catharticus*) germinate in late summer/early fall, grow throughout the fall and winter, and then flower, set seed and die in the spring. Perennial weeds such as clovers, dallisgrass, and nutsedge may grow during warmer or cooler months, but have perennial structures year-round. Additional information on the weed life cycles can be found at https://aggieturf.tamu.edu/turfgrass-weeds/.

Table 1. Pre-emergence herbicides for use in bermudagrass lawns.

Herbicide	Pre/post\ Emergent	Controls	Notes	Found In
corn gluten meal	Pre	grasses	An organic product. May not be as effective as options listed below.	Maize Weed Preventer, many others
dithiopyr	Pre	grasses, some broadleaves	Will control crabgrass plants shortly after they germinate. Can be applied up to a few weeks after crabgrass germination.	Bonide crabgrass preventer, many others
pendimethalin	Pre	grasses, some broadleaves	May stain concrete and brick pavers. Sweep product from hardscapes immediately after application or be careful when applying in these areas.	Scotts Halts Crabgrass Preventer, Pre-M, many others
prodiamine	Pre	grasses, some broadleaves	May stain concrete and brick pavers. Sweep product from hardscapes immediately after application or use caution when applying in these areas.	Barricade
isoxaben	Pre	broadleaves	Will not control grassy weeds such as crabgrass or annual bluegrass.	Gallery, Fertilome Broadleaf Weed Control with Gallery

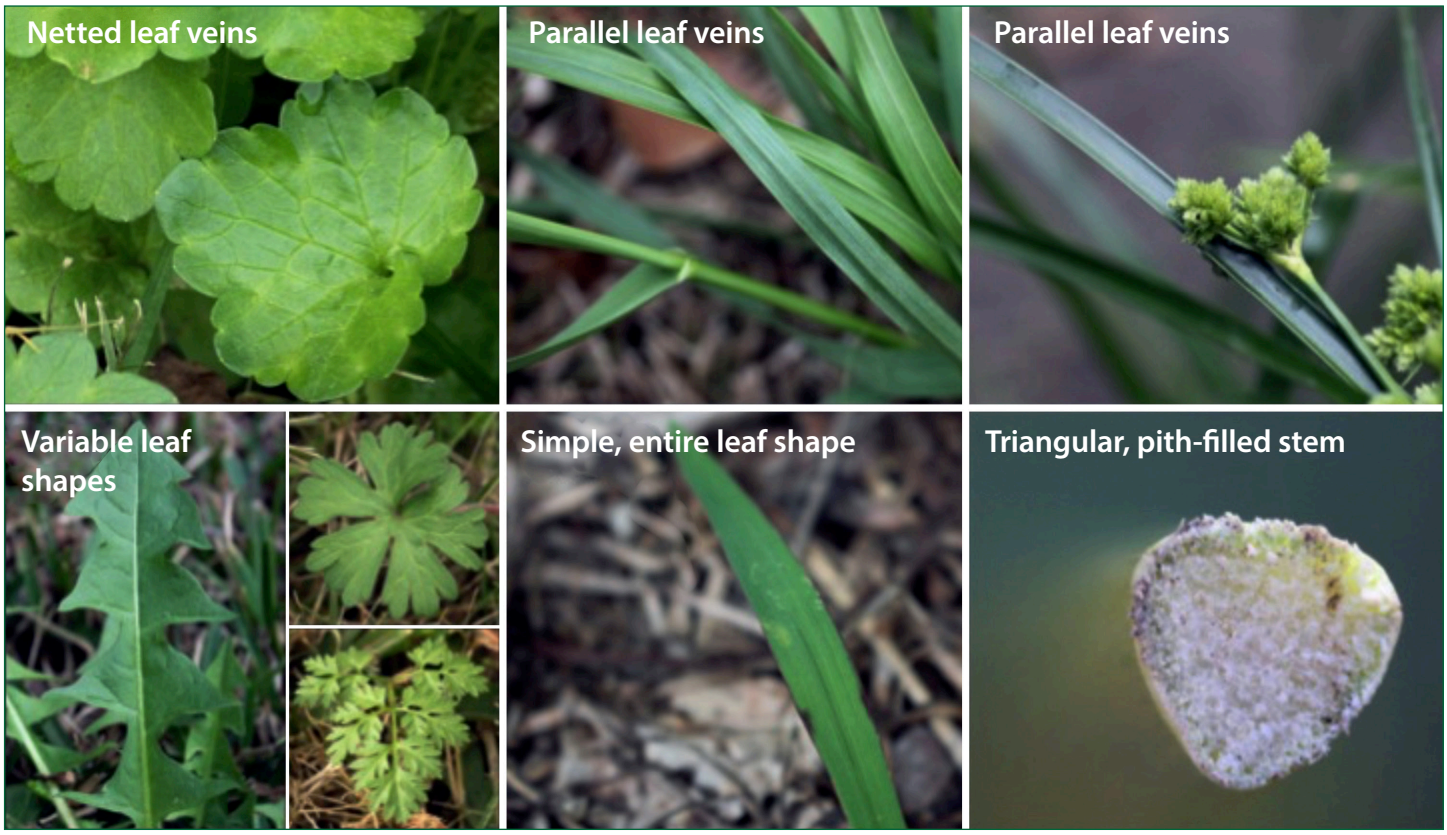


Figure 4. Various leaf shapes (left, broadleaf; middle, grass; right, sedge)

Grassy weeds

Annual grasses are most easily controlled with pre-emergence herbicides (Table 1). These herbicides are effective only if they are applied uniformly and are watered into the soil by rainfall or irrigation before the target weed emerges. Pre-emergence herbicides will not control weeds adequately after they emerge. Controlling annual grasses with pre-emergence herbicides is important because post-emergence control has fewer options and the results can be inconsistent.

Summer annual grassy weeds

Crabgrass is usually the first summer annual grass to germinate and lawns with a history of crabgrass should be treated with pre-emergence herbicides before this occurs. Germination typically occurs during mid-March in the Panhandle region, early March in North and Central Texas, and mid-February in South Texas.

When using pre-emergence herbicides formulated on granular carriers such as fertilizer, it is important to apply products with little to no nitrogen. Nitrogen should only

Table 2. Post-emergence herbicides for use in bermudagrass lawns.

Herbicide	Controls	Notes	Found in
2,4-D	broadleaves	Will not control clovers.	Weed-B-Gon, weed-n-feed products, many others
carfentrazone	broadleaves	Provides a quick "burn down" on broadleaf weeds but not grasses.	Usually mixed with other herbicides.
dicamba	broadleaves	Can be absorbed through roots; do not apply near shallow-rooted trees. Usually combined with 2,4-D to increase weed control of clovers.	Weed-B-Gon, weed-n-feed products, many others
imazaquin	sedges	Provides good control of yellow and purple nutsedge.	Image Kills Nutsedge
MCPA	broadleaves	Usually combined with 2,4-D to increase weed control	Weed-B-Gon, weed-n-feed products, many others
mecroprop-p (MCPP)	broadleaves	Usually combined with 2,4-D to increase weed control	Weed-B-Gon, weed-n-feed products, many others
metsulfuron	broadleaves	Can be absorbed through roots; do not apply near shallow-rooted trees. Excellent control of many broadleaf weeds, limited control of others. Will take 2 to 3 weeks before weed dies.	Certain Scotts Bonus S products. Scotts Spot Weed Control for Southern Lawns
penoxsulam	broadleaves	Will take 2 to 3 weeks before weeds die. May not control larger weeds when applied alone	Fertilome Dollarweed Control
quinclorac	certain grasses, clovers	Will provide crabgrass control. Also provides excellent clover control. Do not apply to St. Augustinegrass.	Products that mention crabgrass control. Usually mixed with 2,4-D and other broadleaf herbicides
sulfentrazone	yellow nutsedge, broadleaves	Will control yellow nutsedge but controls purple nutsedge poorly.	Ortho Nutsedge Control, Bonide Sedge Ender
triclopyr	broadleaves	Controls clovers better than 2,4-D, MCPA, or MCPP. Will cause bermudagrass injury if applied alone. Use only when part of combination product. Check the label to make sure it can be applied to bermudagrass.	Bonide Chickweed Killer, many others

be applied to green, actively growing bermudagrass. For bermudagrass lawns, it is more appropriate to select a pre-emergence herbicide on a fertilizer carrier that contains only phosphorous (P) and/or potassium (K).

If pre-emergent herbicides are not used, crabgrass can be controlled with post-emergent herbicides that contain quinclorac (Table 2). However, post-emergence crabgrass control may be inconsistent and this herbicide can cause temporary bermudagrass discoloration for 1 to 2 weeks after application. Do not apply quinclorac if St. Augustinegrass is present—it will injure this grass significantly.

Winter annual grassy weeds

Common winter annual grasses in lawns include annual bluegrass (*Poa annua*) and rescuegrass. Applying a pre-emergence herbicide in the fall is less common, but in lawns with a history of these weeds, certain pre-emergent herbicides listed in Table 1 can be applied from mid-August to mid-September. Even if you apply a pre-emergence herbicide in the spring to control summer annual weeds, you must treat again in the fall to control winter annual weeds. Do not apply a pre-emergent if you are planning to overseed with ryegrass in the fall.

Perennial grassy weeds

It is difficult to control perennial grassy weeds such as dallisgrass or bluestem (*Bothriochloa* species). Post-emergence herbicides available in retail stores for controlling grassy weeds mostly target crabgrass. Small infestations of perennial grassy weeds can be removed by hand. However, be sure to remove the entire clump and the underground rhizomes, or it will regrow. For large plants, you may need a shovel to completely remove them and backfill the hole with topsoil.

Bahiagrass is a pasture grass that invades lawns primarily in East Texas. Products that contain metsulfuron-methyl (certain Scotts Company products) will provide bahiagrass (*Paspalum notatum*) control, but repeat applications may be necessary.

Broadleaf weeds

Post-emergence herbicides control annual and perennial broadleaf weeds more easily than they do grasses. These herbicides (Table 2) should be applied after the target weed has emerged—they are effective when the herbicide can be absorbed through the leaves. It is important to apply these products to healthy, actively growing, turfgrass at the rate indicated on the product label. Always follow the label directions regarding appropriate environmental conditions—avoid treating a lawn that is under drought stress or that is greening up in the spring.

In addition to liquid post-emergence herbicides, "weed and feed" products that contain fertilizer with a post-emergent broadleaf herbicide combined with fertilizer are widely available. These are popular because they can be applied using a fertilizer spreader instead of a sprayer. Most of these products should not be applied around tree and shrub driplines or come in contact with other ornamental plants. Always follow label instructions when applying these products. If weed problems are limited to small areas, consider using fertilizer without weed control and purchasing a herbicide separately for spot treatments.

Annual broadleaf weeds

Pre-emergece herbicides for annual grassy weeds (Table 1) may also partially control annual broadleaf weeds. However, isoxaben is a pre-emergence herbicide that controls pre-emergence broadleaf weeds and may be a good option where annual broadleaf weed infestations are severe.

Annual broadleaf weeds are easily controlled with post-emergence herbicides while plants are small, before they begin to flower. This is usually during early fall for winter annual broadleaf weeds and late spring for summer annual broadleaf weeds. Herbicides applied to flowering weeds late in their growing season may not be effective. Remember that after annual weeds flower and complete their life cycle they soon die. It may not be worth the time and expense to control a weed that will die naturally within a few weeks.

Perennial broadleaf weeds

Many perennial broadleaf weeds can treated with the same herbicides (Table 2) that control annual broadleaf weeds, but their perennial growth habit, makes control more difficult. Perennial weeds may re-grow and require repeat applications.

For cool-season perennial broadleaf weeds such as clover, make applications in fall or spring when temperatures are mild and weeds are actively growing. These herbicides will not be effective when daytime temperatures are less than 60 °F. For warm-season perennial broadleaf weeds such as Virginia buttonweed (*Diodia virginiana*), applications are most effective in mid to late spring after weeds emerge from winter dormancy or in early fall before they enter winter dormancy.

Sedges

Nutsedge and kyllinga species can be difficult to control because they are perennials that grow from underground rhizomes and/or tubers. They emerge in late spring/early summer when soil temperatures increase, grow throughout the summer months, then disappear at first frost.

Removing sedges by hand often stimulates underground tubers and can make the problem worse. Products that contain halosulfuron-methyl (Sedgehammer) and sulfentrazone (Ortho Nutsedge Killer for Lawns) will control yellow nutsedge. Products that contain sulfosulfuron (Certainty) or imazaquin (Image Kills Nutsedge) will control yellow and purple nutsedge. The best time to apply these herbicides is mid to late spring after sedges have emerged from the canopy. Repeated applications may be necessary.

For more information on nutsedge and kyllinga see "Nutsedege and Kyllinga Control for Homeowners" at https://aggieturf.tamu.edu/wp-content/uploads/NutsedgeFINAL.pdf.

Insects and diseases

Several insects and diseases may affect bermudagrass lawns—proper identification is the first step to effective control. Insects and diseases affect bermudagrass at various times and produce very different symptoms depending on the causal agent. Common insect pests include white grubs, fall armyworms, and fire ants. Occasional pests include bermudagrass mites, hunting billbugs, and sod webworms. More information on turfgrass insects is available from https://aggieturf.tamu.edu/turfgrass-insects/.

Common diseases include take-all root rot, spring dead spot, and large patch. Over irrigation and application of nitrogen fertilizer in the early fall can increase the incidence and severity of large patch. You can identify diseases properly by sending samples to the Texas Plant Disease Diagnostic Laboratory. Procedures, forms, and costs are at http://plantclinic.tamu.edu.

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The Texas A&M University System, U.S. Department of Agriculture, and the County Commissioners Courts of Texas Cooperating.

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