Turfgrass Management

for the Texas Panhandle

Grass Types
Establishment
Lawn Care
Weed Control
Insects and Diseases

Ogallala Aquifer

AgriLIFE EXTENSION
Texas A&M System

SCS-2012-03

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Turfgrass Management for the Texas Panhandle

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Published 2012

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Turfgrass Management for the Texas Panhandle

Congratulations! You live in an area of Texas that allows you to grow both warm-season grasses and cool-season grasses.

Lawns are a resource to be managed in our landscapes. They provide economic, environmental and recreational benefits, as well as serve as a frame of beauty with the home as the focal point.

Selecting a Grass

The first step toward selecting a grass for your lawn is knowing your needs. Think about how much time, water, fertilizer and effort can be put into the lawn and select a grass that is adapted to your specific needs and conditions.

Environmental conditions and your intended management practices are linked together when trying to determine which turfgrass is best adapted to your site. Remember that management practices can have an overriding influence on turfgrass selection. If the grass will not be watered or mowed frequently, choose a grass that meets low maintenance requirements, like buffalograss. High-level maintenance grasses such as Kentucky bluegrass require frequent watering, at least weekly mowing, multiple applications of fertilizer and occasional pest control.

Match grass with needed maintenance requirements.

To identify grasses that best fit your environmental conditions and maintenance requirements, refer to the grass descriptions in Table 1 on Page 2.

Table 1. Characteristics of Grasses Recommended for the Texas Panhandle.

Drought Tolerance	High Temperature Tolerance
Most Tolerant	**Most Tolerant**
Buffalograss	Buffalograss
Zoysia Japonica	Zoysiagrass
Common Bermudagrass	Improved Bermudagrass
Improved Bermudagrass	Common Bermudagrass
Zoysia Matrella	Tall Fescue
Tall Fescue	Kentucky Bluegrass
Kentucky Bluegrass	
Least Tolerant	**Least Tolerant**

Cold Tolerant	Annual N Requirement
Most Tolerant	**Least**
Buffalograss	Buffalograss
Kentucky Bluegrass	Zoysiagrass
Tall Fescue	Tall Fescue
Zoysiagrass	Kentucky Bluegrass
Common Bermudagrass	Common Bermudagrass
Improved Bermudagrass	Improved Bermudagrass
Least Tolerant	**Most**

Shade Tolerance	Traffic Tolerance
Most Tolerant	**Most Tolerant**
Fine Fescue	Zoysiagrass
Zoysia Matrella	Improved Bermudagrass
Tall Fescue	Common Bermudagrass
Kentucky Bluegrass	Buffalograss
Zoysia Japonica	Tall Fescue
Common Bermudagrass	Kentucky Bluegrass
Buffalograss	
Least Tolerant	**Least Tolerant**

Grass Descriptions

Warm-Season Grasses

Warm-season grasses adapted to the Panhandle are Bermudagrass, zoysiagrass and buffalograss. These grasses generally require less maintenance, require less water and are more heat tolerant than the cool-season grasses. Warm-season grasses grow best in the middle of the summer, but will not green up as early in the spring and will go dormant earlier in the fall than the cool-season grasses. When establishing warm-season grasses it is best to seed, sod, sprig or plug these grasses in the late spring when soil temperature is greater than 60˚F. Generally mid-May is a good time for establishing warm-season grass in the Panhandle. Once established, buffalograss will spread by stolons (above ground horizontal growing stems) while Bermudagrass and zoysiagrass will spread by stolons and rhizomes (underground stems).

Bermudagrass

Bermudagrass is a warm-season turfgrass that has excellent heat and drought tolerance, good cold tolerance and excellent wear tolerance. However, Bermudagrasses have poor shade tolerance and need at least seven hours of daily direct sunlight to produce a healthy lawn. There are two main types of Bermudagrasses that can be used for home lawns: the common types and the hybrid/vegetative Bermudagrasses. As a general rule, the common types will require less maintenance.

A. Common Bermudagrass

Common Bermudagrasses can be planted from seed, sod or sprigs. The best time to seed common Bermudagrass is in the late spring after soil temperatures have reached 60 to 65˚F. Seed common Bermudagrass at 1 to 2 pounds of seed per 1,000 sq. ft. Yukon and Riviera are two new seeded Bermudagrasses that have improved cold tolerance. Other common Bermudagrasses include: Common, Sahara and Sultan.

B. Hybrid/Vegetative Bermudagrass

These Bermudagrasses as a general rule require more maintenance than the common types. They generally do not produce viable seed and therefore have to be planted from sod, sprigs or plugs. However, Princess-77 is a new seeded-type hybrid Bermudagrass that can be established from seed as well as sod, sprigs or plugs. Patriot is a recently released hybrid Bermudagrass that has improved cold tolerance. Other hybrid/vegetative Bermudagrasses include: Tifway, TifSport, Tifton 10, Midiron and Midlawn.

Zoysiagrass

Zoysiagrass, when properly maintained, will produce one of the most dense, attractive lawns in the south. Zoysiagrass varieties have good to excellent drought tolerance, good cold tolerance, good to excellent wear tolerance and moderate to very good shade tolerance. Meyer zoysiagrass, one of the older varieties, has excellent cold tolerance, but poor drought tolerance. New improved zoysiagrasses for home lawn use include: Palisades, JaMur, Crowne, Shadow Turf and Empire. These improved zoysiagrasses have to be planted by sod or plugs.

Buffalograss

Buffalograss is the only true native turfgrass readily adapted to the Panhandle. Buffalograss is best adapted for areas with annual rainfall of 25 inches or less. It has excellent drought and cold tolerance. However, like Bermudagrass, it has poor shade tolerance. Buffalograss will survive in lawns with a minimum amount of supplemental irrigation throughout the growing season. Seeded-type buffalograss, such as Topgun, Cody and Bison, should be planted in late spring to early summer when soil temperatures are greater than 60˚F at 2 to 3 pounds of seed per 1,000 sq. ft.

Buffalograss requires the least amount of water and fertilizer of all of the turfgrasses.

Plant breeders have released several new vegetative buffalograsses that are planted by sod or plugs. Most of these new vegetative buffalograsses are female-only plants which are generally finer textured and darker green in color than the male plants. These do not produce a seed head, making for an attractive lawn. Vegetative varieties include: Prairie, Density, Prestige and Tech Turf (formally named Turfallo).

Cool-Season Grasses

Cool-season grasses will thrive in the late spring and early fall months. They are less heat tolerant and require greater maintenance and water than the warm-season grasses. Tall fescue, Kentucky bluegrass and Texas hybrid bluegrass are the most common cool-season grasses grown in the Panhandle. These are best established by seed or sodding in the fall, generally in mid-September.

Tall Fescues

Tall fescue is a cool-season bunch type turfgrass that can provide near year-round green color in lawns for the Panhandle. Tall fescues do not produce stolons and most tall fescues have a very limited rhizome (underground stems) system and therefore cannot spread to fill in thin areas of the lawn. However, tall fescue is a tiillering-type grass that can thicken its stand during the fall with fall application of nitrogen fertilizer. The new improved turf-type tall fescues are better suited for home lawns than the older tall fescues such as Kentucky 31. These improved tall fescues have a finer blade, generally making for a more attractive lawn. Tall fescue has the best drought tolerance of all of the cool-season turfgrasses due to its ability to be deep-rooted in a deep soil. Tall fescues have good cold tolerance, good shade tolerance and fair to good drought tolerance. For best results, seed tall fescue at 6 to 8 pounds of seed per 1,000 sq. ft. in the second or third week of September. There are currently more than 200 varieties of turf-type tall fescues available for use in home lawns. Some of the more popular varieties include: Frontier, Millennium, Shenandoah, Jaquar 3, Rebel 4, Olympic, Crossfire, Houndog 5, Aztec II and Mustang II. While most tall fescue is planted from seed, a few sod growers in the state sell tall fescue as sod. Fall is the best time to plant tall fescue from seed or sod. Sod can also be planted in the spring with much greater success than if planted from seed.

Kentucky Bluegrass

Kentucky bluegrass is another cool-season turfgrass that spreads by tillers and rhizomes. It will generally provide near year-round green color in the Panhandle. Kentucky bluegrass has fair shade tolerance, fair drought tolerance and excellent cold tolerance. Kentucky bluegrass will require more water than tall fescue, especially in the summer months. It is also more prone to disease problems in the summer. Seed Kentucky bluegrass at 1 to 3 pounds of seed per 1,000 sq. ft. Kentucky bluegrass is also available as sod. Like fescue, it is best to seed or sod in September. Kentucky bluegrass varieties include: Bristol, Glade, Nugget, Touchdown, Victa, Midnight, Baron and Eclipse. Mixtures of varieties are also sold. A popular mix in the Panhandle is Triple Crown.

Hybrid Bluegrass

The hybrid bluegrasses were developed by crossing Kentucky bluegrass with Texas bluegrass. Texas bluegrass is a native bluegrass found growing naturally in west and southwest Texas. Texas bluegrass has good to excellent drought and heat tolerance. By blending these two bluegrasses together, the turfgrass breeders have developed a bluegrass that provides a high quality, dark green lawn with improved drought tolerance. At this time, there are a limited number of hybrid bluegrasses available. Varieties of hybrid bluegrass include: Reveille, Thermal Blue, Dura Blue and Longhorn.

In some areas of the Southwest, mixed blends of tall fescue and hybrid bluegrass are being planted in home lawns. By blending the hybrid bluegrass with tall fescue, you obtain a darker green lawn with improved drought tolerance. Generally, these lawns are being planted with a mixture of 30 to 40% hybrid bluegrass and 60 to 70% turf-type tall fescue.

Lawn Establishment

To get the most out of your time and labor, consult the following checklist:

1) Remove debris such as rocks, lumber, concrete, etc.
2) Add organic matter such as peat moss or composted manure, well decomposed sawdust or yard waste to improve soil structure. When using compost, make sure the product is fully composted. Many soils in the area lack adequate organic matter. Use a rototiller to mix 1 to 2 inches of organic matter into the top 3 to 4 inches of topsoil.
3) Grade the seedbed to provide drainage away from the house, walks and driveway. A fall of 4 to 6 inches for every 40 to 50 surface feet is adequate. Any soil added should be of a loam or sandy loam texture.
4) Water as often as needed to allow the soil to settle and form a firm seedbed. Do not over water to the point of runoff and soil erosion.
5) Rake the surface to remove any large clods and fill depressions that might develop.
6) These same five steps need to be used for seeding, sodding or plugging.

For additional information on turfgrass establishment, go to the Texas A&M University AggieTurf website Turf Answers 4 You: http://aggieturf.tamu.edu/answers4you/. At this website, click on "Turfgrass Establishment." Two useful publications that can be found at this site are:

- Turf Establishment SCS-2009-06
- Select & InstallSod SCS-2009-07

Seeding

In order to get a uniform seed cover, use a mechanical spreader rather than spreading the seed by hand. For large seed, such as tall fescue and buffalograss, a cyclone-type spreader used for applying fertilizer will work fine. For small-seeded grasses such as Kentucky bluegrass or Bermudagrass, a small handheld seeder will work better. Divide the seed into two areas and seed the second area at right angles to the first. This will help insure a more uniform coverage. Power seeders that actually push the seed into the soil can be rented and work well.

If a power seeder is not used, lightly rake the seeded area to provide a soil surface of shallow ridges and grooves (corrugated) to ensure the seed-soil contact needed for good germination. Be certain not to bury the seed too deeply, no deeper than a depth of 1/8 to 1/4 inch, depending on seed size. If you have access to a roller, roll the area (these can usually be rented) to ensure good seed-soil contact needed for good germination. Adding a light mulch will help protect young seedlings and prevent soil erosion on slopes. When mulching, make sure that there is some exposure of the soil. The last step, one of the most important, is proper watering. Initially apply 1 inch of water to wet soil to a depth of about 6 inches. This is best accomplished by applying 1/3 of an inch of water in three applications in a 24-hour period. By applying less water in multiple applications, seed will not be washed away and soil erosion will be less likely to occur. Next, keep the top layer of soil on the moist-to sometimes-wet side, until the grass emerges. This may mean a light sprinkling two to three times a day. Only apply as much water as necessary to wet the surface. Avoid standing water, but keep the surface moist. Be patient, it may take up to two weeks for the grass seedlings to emerge.

Sodding

While sodding is more expensive up front, research has shown that the total cost for the first year is almost the same for sodding vs. seeding. While sod can be installed almost anytime, the best time to sod warm-season grass is in the late spring through early summer, and the best time to sod cool-season grass is in the fall. When sodding, try to plant the sod as soon as possible after it arrives. If the sod is left on the pallets for longer than

four to five hours, water the sod on the pallets to prevent drying. Also, the soil needs to be moist when the sod is planted.

Remember, the soil preparation for sodding is the same as for seeding. Lay the sod in rows, staggering the seams. Roll and water immediately after completing a section. After the sod is installed, water the lawn thoroughly. Try to get the soil wet to a depth of 6 inches. The edges of the sod along sidewalks and driveways will be the first areas to dry out. These spots may need to be watered every day until they are well rooted.

Care After Establishment

Lawns that are properly mowed, watered and fertilized will have fewer weed and disease problems. Develop a balanced maintenance program that fits your activities. If the lawn is not going to be mowed often, then water and fertilize sparingly.

Mowing Plan

Proper mowing is one of the key cultural practices for producing a dense, healthy stand of turfgrass. The key is to mow often enough so that no more than 1/3 of the leaf blade is removed at any one time. For example, if the lawn is being mowed at a 2-inch height, then once it reaches a 3-inch height, it is time to mow. Removing excess leaf tissue is a stress on the turfgrass plants, and can increase the demand for more water. Month of the year, grass type, mowing height and rate of fertilization will determine how often the lawn needs to be mowed. A lawn that is mowed short will require more frequent mowing and will use more fertilizer. When mowing, it is best to return grass clippings to the soil. These clippings will return nutrients and organic matter to the lawn.

If a mulching blade is not used, grass will need to be mowed more often.

Thatch

A myth is that returning grass clippings will cause thatch to occur. Thatch is made up primarily of stolons, rhizomes and roots. Leaf tissue is very succulent and will break down quickly. Returning grass clippings will decrease the amount of fertilizer needed to produce a healthy lawn. Mowers with a mulching blade work well when grass clippings are going to be left on the lawn. If a mulching-type mower is not used, then mowing should be frequent enough so clippings are easily dispersed across the lawn.

Mowing Heights

Recommended mowing heights for the different turfgrasses are listed in Table 2. Mowing a turfgrass plant too low or even too high will stress the turfgrass and create a lower quality stand of grass. In shade areas and during the hot, dry summer months, mow the grass at the upper end of the recommended mowing-height range. Also, if the lawn can only be mowed once per week in peak growth periods, then it is better to mow at the upper end of the recommended mowing-height range. However, it should be noted that the more often a turfgrass is mowed, the denser the stand of turfgrass will become.

Keep mower blades sharpened at all times. A dull blade will shred the end of the leaf blade. Not only will this produce a brown, unsightly appearance to the lawn, it can increase the amount of water being lost from the leaf blade tips and it also can increase the invasion of disease-causing fungi.

Keep blade sharp!

Table 2. Recommended Mowing-height Range for the Different Turfgrasses Used in Home Lawns.

Turfgrass	Recommended Height (inches)
Common Bermudagrass	1.5 to 2.5
Hybrid Bermudagrass	0.75 to 1.5
Buffalograss*	2 to 3
Zoysiagrass	1 to 2.5
Tall fescue	2 to 3.5
Kentucky bluegrass	2 to 3.5
Hybrid bluegrass	2 to 3.5

**Buffalograss can actually be mowed at a much higher cut if the homeowner so desires. Just remember that the lower it is cut, the more often it will have to be watered and mowed.*

Watering

Watering is another key cultural practice for healthy lawns. With the exception of buffalograss, all turfgrasses require some supplemental irrigation during the year for survival. If a green lawn is desired throughout the spring, summer and fall months, regular applications of water will be required to supplement natural rainfall. Experience and observations have shown that most homeowners overwater their landscapes. It is estimated that as much as 20 to 25% of municipal water in the spring and fall and up to 60% of municipal water in the summer is being used for irrigation of home landscapes. If water is going to continue to be available for use in home lawns, then homeowners must ensure that they only apply the amount of necessary water for healthy plant growth.

Factors to consider when establishing an irrigation plan are: turfgrass species, soil type, management practices and environmental (weather) conditions.

- Refer to Table 1 on page 2 for ranking of drought tolerance for different turfgrasses.
- Turfgrasses such as buffalograss, zoysiagrass and common Bermudagrass will require less water than tall fescue and bluegrass.
- Soil type, soil quality and soil depth directly affect the ideal frequency and volume of water applied in landscape settings. Heavier soils (clay, loam) can store a large volume of water, but generally have slow water-infiltration rates. Light or coarse soils (sand) allow for very rapid infiltration but can only hold a small volume of water compared to the heavier soils. Therefore, watering strategies should be adapted that best fit the specific soil's properties. In the heavier soils, slow and penetrating irrigations should be planned less frequently (one to three times per week) to allow for deep root development. Run-off should be avoided by using a low sprinkler application rate so that water has time to infiltrate the soil before overflowing the lawn. In some cases, it may be necessary to cycle irrigation events within a one-day period to prevent run-off. For example, if 1inch of water is the desired amount to apply in one day, then the sprinkler can be adjusted to apply 1/3 inch of water in three irrigation events during the 24-hour period. On sandy soils, more frequent irrigations (two to four times per week) with less water should be planned to prevent water drainage below the root zone. The same amount of water will be applied per week with each soil type, but the frequency and duration of the irrigation should be adjusted to achieve the best results. In both cases, developing deep roots and avoid wasting water are primary goals.
- Lawn fertilization is a major influence on plant water use. The more fertilizer applied, the greater the demand for water by turfgrass plants. Turfgrass plants under- or- over-fertilized with nitrogen will not produce a healthy, deep root system. Apply only recommended rates of nitrogen fertilizer needed to produce healthy plant growth. During water restrictions, it is beneficial to reduce the amount of nitrogen applied to the lawn.

- Correct any accumulation of excess thatch in the lawn (> 1/2 inch). Thatch is a buildup of porous, partially decomposed organic debris that builds up at the soil surface. Over time, the growing point of the grass becomes elevated above the soil in the thatch. Thatch does not hold water or nutrients. Thatchy lawns will show moisture stress sooner than ones without significant thatch. Thatch can also become hydrophobic and repel moisture. If thatch is present in a lawn, the runoff can become greater.
- If soil compaction is a problem, aerate the lawn. Compacted soils have limited or reduced amounts of available oxygen for root growth. Turfgrass plants growing in a compacted soil will have shallow, limited root systems and thus require more frequent irrigations. Aeration allows plants to develop a more extensive, deeper root system, thus allowing the plants to survive longer between supplemental irrigations.
- Weather conditions such as high wind, high temperature and low humidity increase water use both through transpiration (water use through a plant) and evaporation from soil surfaces. This is why plants need more water during the summer months. If extreme or severe conditions persist for any period of time, it may be necessary to increase the amount of water applied to a turf area. This may be accomplished by applying more water per irrigation event or by increasing the irrigation frequency. Again, run-off or soil drainage should be avoided. As witnessed during the summer of 2011, watering restrictions may be enacted during extreme drought conditions. In these cases, deep and penetrating irrigation events to re-fill the soil storage are recommended.

Determining When the Lawn Needs Water

Turfgrass shows visible signs of moisture stress by exhibiting rolled or folded leaf blades, footprints in the lawn after walking upon it, or a blue-green to grayish color. These are signs of "wilt." If these wilted "indicator areas" are left to dry out further, they may then begin to turn straw-colored brown. Watering just prior to or at first sight of wilt conditions will allow the lawn to remain active in its growth without going off color. The recommended method to accomplish this is the use of an automatic irrigation controller programmed to apply the total weekly water required split into two to three equal applications each week. Most modern controllers will allow for up to three seasonal irrigation programs (spring, summer and fall) and should be set to match the average water demand in those seasons. Since no two years are the same, small adjustments should be made to this program at the start of each season.

In addition to good irrigation scheduling, recent availability of various sensors has drastically improved the ability for a homeowner to properly irrigation landscape turf. Rain, freeze, soil and wind sensors are currently available at affordable prices and each offer unique benefits.

Rainfall and freeze sensors are required by law in Amarillo and recommended in many areas throughout the Texas Panhandle on new or significantly updated landscape irrigation systems. Rain sensors prevent irrigation events during and after rainfall when significant moisture is present. Freeze sensors prevent irrigation when the temperature is below 32° to prevent turf damage and potential dangers associated with frozen walkways and roadways. Wind speed sensors are also available to help prevent ineffective irrigations and the associated wasted water during severe wind conditions. Although many may feel this sensor is not of value in the Panhandle where it is always windy, this is exactly the condition that this sensor is designed to address. In practice, irrigations should be avoided when sustained wind speeds exceed 10 miles per hour.

Soil-moisture sensors are probably the most useful sensors for managing turfgrass irrigation. In most applications, soil-moisture sensors are installed approximately 6 inches below the soil surface and interrupt scheduled irrigation events when sufficient moisture is present in the soil and allow for the scheduled irrigation to occur when the soil moisture has been depleted. The benefit of this product is that it accounts for plant size, vigor and response to atmospheric conditions. In practice, it is feasible to schedule irrigations to occur early each morning and allow the

Wind, rain and freeze sensors

soil-moisture sensor to select the days when the irrigation events occur.

How Much Water Do Grasses Need?

Water requirements for good turf health differ between cool-season and warm-season grasses. Warm-season grasses will require 25% less water than cool-season grasses when each is actively growing. **The amount of water that should be applied to turfgrass during a given week is the total water requirement minus any significant rainfall amount**. The effective irrigation and/or rainfall needed in Amarillo for a fully irrigated healthy turfgrass is given in Table 3. This is based on historical weather data (1992-2008) from the Texas High Plains ET Network. In order to conserve water, these weekly totals can often be reduced 25% without being detrimental to the long-term health of the turf.

Turfgrass may also need irrigation in the absence of precipitation throughout the winter months. However, water demands throughout these winter months are much lower than during the primary growing season. Dormant warm-season turfgrasses such as Bermudagrass, zoysiagrass and buffalograss benefit from about 0.5 inch of water per month. Cool-season turfgrasses such as tall fescue and Kentucky bluegrass require about 0.5 inches every week, but can get by with applying that amount every two weeks.

Table 3. Weekly Average Water Use of Grasses in the Panhandle.

Month	Fescue/Bluegrass	Bermudagrass	Buffalograss
	Max. Avg. Inches of Water Used per Week for Well Watered Turfgrass		
January	0.6	0*	0
February	0.7	0	0
March	1.0	0	0
April	1.4	1.0	0.7
May	1.7	1.3	0.9
June	2.0	1.5	1.0
July	2.0	1.5	1.0
August	1.7	1.3	0.9
September	1.5	1.1	0.7
October	1.1	0.1	0
November	0.75	0	0
December	0.6	0	0

* Dormant warm-season turfgrasses such as Bermudagrass, zoysiagrass and buffalograss benefit from about 0.5 inches per month.

How Much Water to Apply – Your Ability to Irrigate in Measured Amounts

Rain gauges measure water in inches. Home consumers are charged for water by gallons consumed, yet typically irrigate according to some unit of time watered (minutes).

1) One inch of water is equal to 620 gallons of water for each 1,000 sq. ft. of watered lawn (or 0.62 gallon per square foot).
2) To irrigate in measured amounts (inches), you need to know how long a sprinkler system (automatic or hose and sprinkler) must run to apply 1 inch of water. More on this a bit later under the **water audit section**.
3) Once the amount of time to apply 1 inch of water is known, adjust the time watered so it matches the amount of water needed in inches per week while considering frequency of irrigation.

Best Time to Water

Early morning hours are the best time to water landscapes due to lower air temperatures and typically lower wind speeds. These are ideal conditions to get the irrigation water into the soil where turfgrass roots can use it.

Midday watering leads to increased evaporation water loss and should be avoided. Early evening and nighttime watering should also be avoided as it can encourage plant disease activity, particularly in fall and spring months when temperatures are below 70˚F. If possible, avoid watering when wind speed is excessive since high wind speeds distort sprinkler patterns, causes non-uniform irrigation, and wastes water due to overspray. Wind sensors have shown to be very effective in the Panhandle and can be installed to automatically avoid irrigation during extremely windy conditions.

Irrigation Audit

An audit should be performed on the irrigation system to determine the precipitation rate, or rate at which water is being applied to the turf, usually measured in inches per hour. Homeowners can hire a professional irrigator to do the audit, or they can do their own audit. The recommended method is to place five to eight open-top cans or cups (cat food cans, tuna cans, etc.) throughout each irrigation zone. Run the irrigation system for a 10- to 20-minute period then measure the depth of water in each can with a ruler. To determine the precipitation rate for each zone, add all measurements, divide by the total number of cans used in the audit, then calculate the amount of water applied per hour. This will provide the average precipitation rate for each irrigation zone in inches per hour. The weekly run time for each zone can then be determined by dividing the weekly water requirement by the calculated precipitation rate (in/hr). The run time for each zone should be short enough that no runoff occurs. *Example:* Five cans were placed throughout Zone 1 and the irrigation system was run for 10 minutes. The depth of water in each can was: 0.3, 0.25, 0.25, 0.2 and 0.25 inches respectively. The average depth over the five cans is 0.25 inches in 10 minutes, or 1.5 inches per hour. If 1 inch is the weekly water demand, the irrigation system will need to run for 0.67 hours (1 inch divided by 1.5 inches), or about 40 minutes, throughout the week. This can be broken into three, 12-15 minute waterings spaced through the week.

Irrigation Catch Can Set
(can find online)

Irrigation Systems

The type of irrigation delivery method used can play a very significant role in developing a well-managed turfgrass. Based on our semi-arid atmospheric conditions and predominant soil types, it is generally recommended that low-trajectory sprinkler heads using large stream or droplet sizes and low application rates be used. The two common sprinkler types that fit this description are rotors and rotators. These heads usually have a low application rate that works to reduce run-off and a low, compact stream that resists wind drift. Traditional spray (fan) heads are not generally advised due to their susceptibility to wind drift and their high application rates. Impact heads are very expensive and also promote undesirable drift and are not recommended in most applications. Upgrading a sprinkler system from a spray-type head to a rotor or rotator head is not usually a difficult process and all major sprinkler companies offer products in these categories.

Subsurface drip irrigation (SDI) is a new option in turfgrass settings and can work well in the Texas Panhandle. This type of irrigation system is comprised of rows of dripper tube installed 2- to 4-inches below the soil surface that slowly trickles water to the plant roots. Common dripper tubing has emitters spaced approximately 12 inches along its length and generally installed 12- to 16-inches apart throughout the landscape. This system eliminates wind drift and overspray, but may pose problems with initial turf development. In cases where a new lawn is being installed, dripper tubing may be laid out on a prepared surface with sod laid directly over it. Texas law mandates that all new irrigation systems installed in an area that is less than 4 feet in width must use SDI.

Water-Savings Summary

Run the irrigation system on a set schedule and adjust the run-time incrementally to water just enough to avoid visual signs of turfgrass stress.

- Have your irrigation system checked out for problems such as broken heads, leaking valves, heads not popping up properly, etc. All these problems will result in more water being applied than is actually required.
- Water in early morning hours.
- Use best management practices (fertilization, mowing and aeration) to avoid plant-stress conditions.

Fertilization

Turfgrass plants require 16 essential plant nutrients for proper growth. Fortunately, the plants can receive the majority of these 16 plant nutrients from the soil, air and water. The only sure method to determine which nutrients and how much are needed for your lawn is to conduct a soil test. Homeowners can obtain a soil bag and form for soil testing from their local Texas AgriLife Extension Service county office or they can be found by visiting the Texas A&M Soil Testing Labs website at: http://soiltesting.tamu.edu. On the back of the soil testing form, the procedure for collecting the sample is described. Collect enough soil plugs from numerous areas in the lawn to fill half to two-thirds of the bag. For turfgrasses, collect soil plugs at a 4- to 6-inch depth.

Of the fertilizer nutrients applied, nitrogen is used in the largest quantities. Applying the right amount of nitrogen is very important for healthy plant growth. Excess nitrogen applications can cause thatch buildup, increase demand for water, increase incidence of disease and insect activity, and cause excess top growth at the expense of the plant's root system. On the other hand, too little nitrogen will produce weak plants that are stressed and subject to weed invasion and wear from traffic. Table 4 below lists the recommended range of nitrogen needed for the different turfgrasses in the Panhandle. For most lawns, applying the amount listed in the moderate column should be sufficient.

Table 4. Annual Nitrogen Rate Recommendations for Lawns in the Texas Panhandle Based on Soil Test Level.

Turfgrass Type	Low	Moderate	High
	(lbs. of nitrogen applied per 1,000 sq. ft. per year)		
Common Bermudagrass	2	3	3-4
Hybrid Bermudagrass	2	3-4	4-5
Zoysiagrass	1	2	3
Buffalograss	0-1	1-2	NR*
Tall fescue	2-3	3-4	4-5
Kentucky bluegrass	2-3	3-4	4-5

** NR=not recommended.*

Determining How Much Fertilizer to Apply

The first step in determining how much fertilizer is required is to measure the area of the lawn. Fertilizer recommendations are generally based on pounds of nitrogen per 1,000 sq. ft. Homeowners who measure their lawns are more likely to purchase and apply the correct rate of fertilizer.

The second step in determining how much fertilizer to purchase is determining what actual nutrients are in a fertilizer package. All fertilizer packages must have three numbers present on the package (such as 16-4-8). These numbers represent the percentage of nitrogen, phosphorus and potassium in the package. Occasionally, a fourth number will be present. The fourth number usually represents the percentage of sulfur or iron that is included in the bag. For example, let's use a 40 lb. bag of 16-4-8 fertilizer. The percentage and pounds of each nutrient supplied in the 40 lb. bag is:

Nitrogen (N) = 16% x 40 lbs. = 6.4 lbs. of actual nitrogen
Phosphorus (P) = 4% x 40 lbs. = 1.6 lbs. of actual P2O5
Potassium (K) = 8% x 40 lbs. = 3.2 lbs. of actual K2O

Example: One pound of nitrogen per 1,000 sq. ft. is needed for a home lawn using a 16-4-8 fertilizer. How many pounds of 16-4-8 will be needed to cover a 5,000 sq. ft. lawn?

Step 1. Divide 1 (nitrogen rate) by 16%, which equals 6.2 lbs.
Step 2. Multiply 6.2 x 5 (5,000 sq. ft.) = 31 lbs.

Therefore, 31 lbs. of a 16-4-8 fertilizer is needed to apply 1 lb. of actual nitrogen to the 5,000 sq. ft. lawn.

An easier way to do this is to go to the AggieTurf website: http://aggieturf.tamu.edu.

- Click on Answers 4 You.
- Click on Fertilization.
- Click on Go to Fertilizer Calculator.

Fill in the three boxes for the three steps in "Determine Your Fertilizer Need" and the program will automatically determine the amount of fertilizer needed.

Nitrogen should be applied at a rate of no more than 1 lb. of actual N, especially when using a soluble nitrogen source (quickly available) such as urea or ammonium sulfate. Applying more than this rate can create excess top growth. If a slow-release source of nitrogen is included in the fertilizer, it is possible to apply a higher rate without causing excess top growth. For best results, use a fertilizer that has at least 30 to 50% of the nitrogen in a slow release form.

Amount (ratio) of phosphorus and potassium applied in relation to nitrogen should be determined by a soil test. Many of the soils in Texas, including the Panhandle area, have soils that are high to very high in phosphorus and potassium. If the soil test report indicates a high to very high level of phosphorus, then do not apply phosphorus to the lawn. Use a phosphorus-free fertilizer. Excess phosphorus can tie up other plant nutrients such as iron, manganese and calcium and create nutrient deficiencies in the plant. Also, soils high in phosphorus can increase the level of phosphorus getting into our surface waters. Like phosphorus, many of the soils are also high to very high in potassium. If the soil-test report indicates high to very high levels of potassium, remove potassium from the program in the spring and summer months. Potassium is a key plant nutrient in cold tolerance and should be applied in the fall, even if soil test reports show high to very high levels.

Timing of Fertilizer Application

For warm-season turfgrasses, the first fertilizer application should be applied right after the turfgrass has started to green up and grow. The last fertilizer application should be applied approximately six to eight weeks prior to the expected first frost and the lawn going dormant. For Amarillo, the average first frost date is Oct. 24. The number of fertilizer applications between the spring and fall applications will be determined by the desired level of maintenance. For cool-season turfgrasses, fertilize in late summer, mid-fall and then in late winter and mid-spring. Applying N in the mid-summer months tends to stress and weaken cool-season grasses. Recommended application dates for the different turfgrasses are listed in Table 5 below.

Table 5. Recommended Application Dates for the Panhandle

Turfgrass	Application Dates			
Common Bermudagrass	May 15	July 15		September 1
Hybrid Bermudagrass	May 15	July 1	August 15	September 15
Zoysiagrass	May 15	July 15		September 1
Buffalograss	May 15			September 1
Tall fescue	March 1	May 5	September 1	November 1
Kentucky bluegrass	March 1	May 5	September 1	November 1

Number of fertilizer applications will be determined by quality of lawn desired (see annual nitrogen rate table). For example, if you desire a minimum maintenance common Bermudagrass lawn, then make one or two applications of nitrogen during the growing season. Make one application in the spring and a second application in the fall. If you desire a higher-quality common Bermudagrass lawn, then make three or four applications of nitrogen during the growing season. These should be made in spring, early summer, late summer and then fall. Remember, it is best to not apply more than 1 lb. of actual nitrogen per 1,000 sq. ft. at one time.

Iron Applications

Iron chlorosis (yellow discoloration) is often caused by a deficiency of iron in the leaf tissue of the turfgrass plant. Factors such as high soil pH, calcareous soils, high soil levels of phosphorus, soil compaction and cool, wet soils in the spring can cause iron chlorosis to occur. Also, plant genetics can have an influence on the plant's ability to take up iron from the soil and to convert it to a usable form in the leaf tissue.

Reducing soil pH with an acidifying material such as sulfur can help correct an iron chlorosis problem in some soils. However, research has shown that it is very difficult to lower the soil pH in calcareous-type soils with acidifying-type materials. If soils are not calcareous, then sulfur applications should help. Note: Sulfur applied incorrectly can burn the turfgrass plants. Applying products containing iron is the most commonly used method to correct iron chlorosis in turfgrasses. Iron applications work best when foliar applied yet their greening effect may only last a few weeks. Iron applied to the soil can quickly be tied up in the soil and thus become unavailable for plant use. Look for products containing iron sulfate or iron chelates.

Iron is best applied as a foliar application.

Weed Control

Recommended herbicides for specific weeds in the different turfgrasses may be found in Table 7 on Page 24.

The most effective tool in preventing weeds from becoming a problem in lawns is to produce a dense, healthy stand of turfgrass. Use the best management practices outlined in this publication to form a healthy lawn. Weed seeds need intense light to germinate and a thick stand of turfgrass will prevent light from reaching the weed seeds in the top of the soil.

Knowing the life cycle of the different weeds found in lawns will help homeowners determine what type of herbicide to use and when to apply the herbicide for the most effective results. Refer to Table 6 on Page 23 for a list of common weeds in the Texas Panhandle. Life cycles for weeds include: annuals (summer and winter), biennials and perennials. Annuals will germinate, grow and then die in 12 months or less. Summer annuals will start germinating in late spring and continue to germinate throughout the summer months. They then will die in the fall or early winter months. Examples of summer annuals include: crabgrass, barnyardgrass and some foxtails. Winter annuals will start germinating in early fall and continue to germinate through the fall and winter months until excessive cold weather arrives. They will then die the next spring as soon as hot weather arrives. **The most effective method to control annual weeds is with a preemergent herbicide, which must be applied before the weed seed start to germinate**. For early summer annuals, apply the preemergent by mid-March and for the winter annuals apply the preemergent in early September. Depending on the preemergent herbicide used, a June application may also be needed to provide season-long control. Refer to the herbicide product label for frequency of application needed. Refer to Table 7 on Page 24 for a list of preemergent herbicides and the weeds they control. It is very important that the preemergent herbicides be watered into the soil with approximately 0.5 inches of irrigation as soon as possible after application.

Preemergent herbicides will not control biennial or perennial weeds as a general rule. Examples of perennial weeds are dandelion and bindweed. These weeds come back each year from tap roots, bulbs and/or extensive

rhizome systems in the ground. Biennials and perennials will need to be controlled with a preemergent herbicide. Most broadleaf weeds can be controlled by applying one of or a combination of what are called hormone herbicides. Examples of these are 2,4-D, dicamba and MCPP. These are sold under many different trade names. Herbicides are most effective when the weeds are young and actively growing. Also refer to Table 7 on Page 24 for a list of herbicides for post-emergent broadleaf weed control.

When applying the hormone-type herbicides, care must be taken to not allow any of these herbicides to drift onto desirable trees, shrubs or garden plants. While they will not generally kill shrubs and trees, they can cause serious damage to these desirable plants. Try to spray in early morning or late evening hours when the wind is not blowing at excessive speeds.

Some fertilizers are sold as **"weed and feed"** products that contain hormone-type broadleaf herbicides. In order for these to work effectively, good coverage is essential. In addition, the lawn must be wet (irrigated) prior to application in order to dissolve the granular material on the weed leaves.

Insects

There are several kinds of insects that live in a typical lawn. Many insects are beneficial and aid in the decomposition of organic matter, improve soil structure and are predators of harmful insects. This is one reason why the homeowner must avoid excessive use of insecticides, applying them only when a pest population requires control. Another reason is that after many years of using the same chemicals, some insects have developed resistance to the insecticide.

Insecticide Selection

There are numerous products sold for control of insects infesting a lawn. Many of these products have multiple uses for controlling other insect pests outdoors. Often, the trade names of these products are very similar sounding, but may contain different types of chemicals as their active ingredient**. When selecting a product for a specific pest, always read the label to determine that the pest to be controlled is listed.**

White Grubs

We are fortunate that few insects damage the grass in this area. The insect that causes the most damage is the white grub, the larvae of the June beetle.

White grub infestations are characterized by irregular patches of brown grass that roll back easily. The first symptoms are similar to the signs of moisture stress due to the feeding damage caused to the roots. If grass is easily pulled up, white grubs should be suspected. Grubs kill the grass by feeding on the roots. If four or more grubs are found per square foot, treatment is justified. They are whitish or grayish in color, have brown heads and dark hind parts. **The most effective time to treat grubs in this area is during mid-July to mid-August while grubs are small and actively feeding on the roots.** Sometimes, a spring treatment may be necessary, but this should be followed with a late-summer treatment. For a spring treatment to be effective, a rising soil temperature plus good soil moisture is needed for grubs to be up in the root zone.

For control of white grubs, refer to Table 8 on Page 26. Controls for white grubs include products: 1, 3, 5, 6, 7 and 10. Thatch accumulation of 1/2 or more will tend to tie up insecticides, reducing their effectiveness in white grub control (see section on thatch accumulation).
After application, the insecticide should be promptly irrigated with sufficient water (at least 0.5 inches) to carry the insecticide into the soil where the white grubs live.

Sod Webworms, Cutworms, Armyworms and Fall Armyworms
Other insects that occasionally cause problems in our lawns are: sod webworms, cutworms, armyworms and fall armyworms. These larvae feed on grass leaves. Both sod webworms and cutworms feed at night around a small burrow or tunnel in the turf. Silken threads can be seen covering the tunnel of the sod webworm.

The fall armyworm larvae is about 1.5 inches long at maturity, light green to almost black in color with light body stripes and an inverted "Y" on the head. They feed mostly at night.

For control of sod webworms, cutworms, armyworms and fall armyworms, refer to Table 8 on Page 26.

Controls for sod webworms include products: 1, 2, 3, 4, 5, 7, 8, 9 and 10.

Controls for cutworms include products: 1, 2, 3, 4, 6, 7, 8, 9 and 10.

Controls for armyworms include products: 1, 2, 3, 4, 5, 7, 8, 9 and 10.

Controls for fall armyworm include products: 3, 4, 5 and 9.

Chinch Bugs
Chinch bugs attack both cool- and warm-season turfgrasses. The adult chinch bug is about 1/8 inch long, and black with white patches on its wings which fold over the back. Symptoms include yellow or wilted patches usually appearing during July and August when the turf is under moisture stress. For control of chinch bugs refer to Table 8 on Page 26. Controls for chinch bugs include products: 2, 3, 4, 6, 7 and 9.

Diseases

To diagnose a plant disease, it is necessary to first determine whether the symptom is really being caused by a microorganism pathogen or by an insect, herbicide or even by an environmental factor or cultural practice. First, examine the grass for the presence of insects. If none are found, then most likely insects are not the culprit. Check to see if any herbicide has been recently applied. If so, check the herbicide label to make sure it was labeled for the particular grass and was applied properly. Once these have been ruled out, consider the following environmental and cultural practices:

- Toxic substances in the soil.
- Lack of essential nutrients, water or oxygen.
- Excessive soil temperature.
- Shading.
- Soil compaction.
- Competition from tree roots.
- Improper watering.
- Improper mowing height.

These are some factors that cause symptoms similar to disease or can promote the development of a disease.

Most diseases that damage home lawns can be prevented with proper lawn management. For a plant disease to occur, three factors must be present: a susceptible host, a pathogen (i.e., fungi, bacteria or viruses) in high numbers, and a set of environmental conditions that favor disease. **In many cases, the homeowner can break the disease cycle by using approaches ranging from cultural practices to the use of chemicals such as fungicides.**

Excessive application of nitrogen is the No. 1 cause of thatch accumulation in turfgrasses. Note: It's not the amount of nitrogen in the bag, but how much you apply that counts. Over-fertilizing and under-fertilizing can make the lawn more susceptible to disease. Thus, timing of fertilizing is important. Thatch also is an important factor contributing to the frequency of disease in the home lawn. Movement of air, water and fertilizer is restricted by thatch. To help prevent diseases, follow the guidelines given for selecting a cultivar, mowing, watering and fertilizing.

Contact your county AgriLife Extension agent regarding questions on plant diseases or where to send diseased samples for diagnosis.

Some of the most common turfgrass diseases found in this area are listed below.

Large Patch or Brown Patch *(Rhizoctonia solani)*
Large, irregular to circular patches several feet in diameter. These patches may sometimes have a brown to gray smoke ring at the edge of the circular pattern. Grasses affected by this fungi include: Kentucky bluegrass, Tall fescue, Bermudagrass, zoysiagrass and buffalograss. Brown patch is most active on the cool-season grasses in late spring through mid-summer, while it is most active on the warm-season turfgrasses primarily in the fall months. An exception to this is buffalograss. Brown patch is most often found in buffalograss in late spring. Leaves that are blighted are usually killed. However, grass in the center of a patch may recover or may be unaffected by the fungus. Fungicide applications may allow for growth of new leaves from crowns, rhizomes and stolons that survived. For control of brown patch, use one of the fungicides found in Table 9 on Page 27. Fungicides for brown patch control: 1, 2, 3 and 4.

Leaf Spots *(Bipolaris* spp., *Drechslera* spp.*, Exserohilum* spp. and others*)*
These leaf spot diseases can usually be identified by elongated to circular lesions (spots) with gray to tan centers and purplish to brown margins. Leaves will turn tan to straw colored if crown rot develops. Most diseases caused by species of *Bipolaris* and *Exserohilum* usually occur in warm-season grasses while *Drechslera* usually infects cold-season grasses. Species of *Bipolaris* and *Exserohilum* can be most destructive during wet and cool periods from fall through spring. Leaf spots caused by most species of *Drechslera* usually prevail in wet and cool weather during fall and spring. Turfgrasses affected by leaf spots include: Kentucky bluegrass, perennial ryegrass, tall fescue, Bermudagrass, buffalograss and zoysiagrass. For controls of leaf spot, refer to Table 9 on Page 27. Fungicides for leaf spot control: 1, 2 and 4.

Fairy Ring (*Agaricus* spp., *Calvatia* spp., *Lycoperdon* spp., *Marasmius* spp., *Scleroderma* spp., *Tricholoma* spp. and others)
Fairy ring disease appears as rings of dark green grass surrounding areas of dead or light-colored grass. Most of these fungi will produce mushrooms (toadstools) or even puffballs. Mushrooms usually develop in a circle outside of the dark green or brown ring during heavy rainfall periods or irrigation. The fungus feeds on organic matter. The ring of brown or dead grass is caused by lowering soil moisture where the fungus is concentrated. Control includes aerating the soil and drenching the infected area with a fungicide. Control is difficult.

Since these rings may be more prevalent in dry and nutritionally deficient turf, deep irrigation and moderate amounts of nitrogen could be applied to reduce symptoms. Weeds may colonize dead spots or patches caused by the disease. Regular mowing will remove the mushrooms. Mushrooms and other structures produced by several of the fungi that cause fairy ring may be poisonous and should not be consumed.

Dollar Spot (*Sclerotinia homoeocarpa*)
Dollar spot is a disease that is common on both warm- and cool-season turfgrass species. Small 1 to 2 inch areas in the lawn with distinct straw- to tan-colored sunken spots can be observed in closely mowed lawns. One can find white to tan banding of leaf blades on the perimeter of the patch. In severe cases, spots may coalesce and become large irregularly shaped. In home lawns and/or where turf is longer in length, it is not uncommon

for individual bleached looking patches of turf to be up to 6 inches in diameter. Early morning inspection of the affected areas will often reveal a white growth (fungal mycelia) in the affected patches which is often mistaken for spider webs. However, mycelium will disappear as leaves dry out.

Increase in disease levels can occur when weather is warm and humid but also when cool nights allow for heavy dews to accumulate on the blades and promote fungal growth. Other factors such as low nitrogen availability and dry soils will further encourage disease development. Temperatures more conducive for disease development may range anywhere from 60 to 85°F. Turfgrasses affected by dollar spot include: Kentucky bluegrass, perennial ryegrass, tall fescue, Bermudagrass and zoysiagrass. For control of dollar spot refer to Table 9 on Page 27. Fungicides for dollar spot control: 1, 2, 3 and 4.

Rusts *(Puccinia* spp., *Uromyces* spp. *and Physopella compressa)*
Symptoms for rust include orange- to reddish-colored pustules on the leaf blades resulting in yellow patches in the lawn. These pustules (rust) are easily rubbed off on the leaf. Moist, humid, moderate temperatures encourage rust activity. It is also more prevalent in shade areas and where low nitrogen conditions are present. This disease is most active in early spring, when growth rate of turfgrass is slowed. In the Panhandle, generally rust will only affect cool-season grass or zoysiagrass. For control of rust, refer to Table 9 on Page 27. Fungicides for rust control: 1, 2, 3 and 4.

Powdery Mildew *(Blumeria graminis)**:***
Affected areas will have fine, white powdery or dusty patches of fungal growth on leaves, leaf sheaths and stems. Older leaves are usually more infected than younger leaves. When heavily infected, the entire leaf may turn yellow, then brown as leaves begin to die. White powdery fungal growth will later darken as they age and form tiny, dark structures (cleistothecia) that produce spores. Powdery mildew is more of a problem in shaded areas in a lawn. Similar to rust, powdery mildew will only be present under wet, humid conditions.
Powdery mildew may weaken the plant and mortality can occur due to stresses such as drought or by other diseases. Turfgrasses affected by powdery mildew include: Kentucky bluegrass, perennial ryegrass, Bermudagrass and zoysiagrass. For control of powdery mildew, refer to Table 9 on Page 27. Fungicides for control of powdery mildew: 1 and 4.

Summer Patch *(Magnaporthe poae)*
This disease is a very aggressive root disease of bluegrass and fescue. Symptoms for this disease include circular patches 0.5 to 3 feet in diameter with initial symptoms resembling thin, wilted patches of turfgrass. Affected areas will have roots that are short and dark brown to black in color. Generally occurs in mid-summer to early fall. Patches will develop and their shape is usually irregular but could develop a ring pattern. Patches can potentially coalesce. In some cases, centers of a patch may become recolonized and green again. Refer to Table 9 for control of summer patch on Page 27. Fungicides for control of summer patch: 1, 2, 3 and 4.

Slime Molds (*Mucilago crustacea*, *Didymium squamulosum, Physarum* spp., *Fuligo* spp. and others)
Slime molds do not cause disease but their presence as white, brown, yellow, gray, pink and purple patches on the grass may be of concern. These slime molds are utilizing the stem and leaves to maintain their reproductive structures. Light to dark gray fruiting bodies appear on grass blades. Grass may appear to be covered with soot. Colonized grass usually does not die or become yellow, and the signs of the mold tend to disappear within seven to 14 days. Both cool, wet and humid weather as well as warm, wet and humid weather favor the movement and spread of the fungus. Cultivation practices to reduce thatch can potentially decrease slime mold incidence. Control includes mowing and proper watering. The use of fungicides is not recommended.

Spring Dead Spot *(Ophiosphaerella agrostis)*
Symptoms for spring dead spot include sunken circular patches 1 to 3 feet in diameter. These sunken patches will show up in the lawn as it is greening up in spring months. While symptoms appear in the spring, activity of the disease actually occurs in the previous late- summer to fall period. Excess applications of nitrogen fertilizer,

heavy thatch layer (greater than .5 to 1 inch) and compacted soils will encourage the activity of spring dead spot. While spring dead spot is primarily a problem on Bermudagrass, it has also been isolated in zoysiagrass in Australia. When dead spots are few, it may be useful to remove plugs. Some of the new, improved cold-tolerant Bermudagrasses have demonstrated good tolerance to spring dead spot activity. For control of spring dead spot, refer to Table 9 on Page 27. Fungicides for control of spring dead spot include: 1 and 2.

Non-Pathogenic (Abiotic) Diseases
These include iron chlorosis, soil compaction, dog-urine injury, fertilizer burn and herbicide injury.

Other Lawn Problems

Thatch
Thatch is an accumulation of living and dead plant tissues between the soil and the green leaves of grass. Thatch is not entirely bad. One-half inch or less of thatch is desirable because it reduces soil compaction, increases wear tolerance and conserves soil moisture. Problems may arise if thatch accumulation gets beyond 1/2 inch. Too much thatch will reduce water infiltration, tie up pesticides, encourage insect and disease infestations, and contribute to a shallow-rooted turf.

Thatch is caused by the fast growth of tissues high in lignin such as roots, rhizomes, stolons and crowns. Also, excess tree leaves will add to the problem. Grass clippings, providing the lawn is mowed frequently, will not greatly contribute to thatch accumulation. The leaf blades are high in water, cellulose and protein and are rapidly decomposed by soil microbes. To prevent a thatch problem, do not over-fertilize with nitrogen, water thoroughly and infrequently, mow frequently and at the proper height. Other practices to control thatch include vertical mowing, aeration with hollow tines and top dressing with soil or soil mixture.

Shade
Grasses must have some direct sunlight for normal development and growth. Tree and building shade decrease available light. Tree roots compete with grass for soil moisture and nutrients. Closely spaced plantings of trees, ornamentals, fencing near buildings or other structures can create an environment of high humidity and reduced wind movement that favor disease development. If you are landscaping a new yard, consider the type of tree you plan to use (evergreen or deciduous). Deciduous trees will be more compatible with grass than evergreen trees that exclude sunlight year round.

Grasses respond to excessive shade by producing a weak, shallow- rooted plant that is more susceptible to environmental stress and disease problems. In shade areas, plant only turfgrasses that have good shade tolerance such as tall fescue and zoysiagrass. However, if there is less than four hours of direct sunlight available under the trees, then planting of ground covers with good shade tolerance should be considered.

Several management techniques can be used to enhance the health of grass growing in shade: mowing at a higher setting than grass in full sun; frequent mowing; deep and infrequent watering; and watering in early morning to allow grass to dry before night. Fertilizer application of nitrogen to shaded cool-season grasses should be avoided during the summer months. Low-growing shrubs and tree limbs may have to be selectively pruned to allow more light to reach the turf. If these methods do not result in an acceptable turf, consider using ground covers or non-living materials in shaded areas.

The Future

In a 2004 turfgrass survey, it was determined that home lawns make up approximately 57% of the total acres of managed turfgrasses in Texas. This equates to slightly less than 2 million acres of turfgrass. With the increasing water shortages in Texas, it is very important that homeowners learn to only apply the necessary water as well as nutrients and pesticides to their lawn. Continued water issues could lead to severe restrictions in available water for lawns in the future.

It should be noted that lawns provide many benefits to our environment. Lawns produce oxygen, reduce runoff of fertilizers and pesticides, reduce glare, act as an air conditioning system by reducing temperatures around the home, reduce noise levels and provide an attractive, enjoyable recreational area in the landscape. Research has shown that a well-managed landscape can increase the sale of a home by as much as 15 percent.

Table 6. Common Turfgrass Weeds Found in the Panhandle.

Weed	Life Cycle	Plant Type
Annual bluegrass	Winter annual	Grass
Bindweed	Summer annual	Broadleaf
Black medic	Summer annual	Broadleaf
Bur clover	Winter annual	Broadleaf
Common chickweed	Winter annual	Broadleaf
Crabgrass	Summer annual	Grass
Dandelion	Winter biennial/perennial	Broadleaf
Dichondra	Summer perennial	Broadleaf
Curly dock	Winter perennial	Broadleaf
Foxtail, giant	Summer annual	Grass
Foxtail, green & yellow	Summer annual	Grass
Goathead (puncture vine)	Summer annual	Broadleaf
Henbit	Winter annual	Broadleaf
Little barley	Summer/winter annual	Grass
Mallow, common	Summer annual	Broadleaf
Mouse eared chickweed	Winter perennial	Broadleaf
Oxalis, yellow woodsorrel	Summer annual	Broadleaf
Plantain, buckhorn	Winter perennial	Broadleaf
Prostrate knotweed	Summer annual	Broadleaf
Prostrate pigweed	Summer annual	Broadleaf
Purslane	Summer annual	Broadleaf
Purple nutsedge	Summer perennial	Sedge
Rescue grass	Winter annual	Grass
Sandbur, field (grassbur)	Summer annual	Grass
Shepard's purse	Winter annual	Broadleaf
Sow thistle	Winter annual	Broadleaf
Spotted spurge	Summer annual	Broadleaf
Virginia pepperweed	Winter annual	Broadleaf
White clover	Winter perennial	Broadleaf
Wild onion/garlic	Winter perennial	Grass
Yellow nutsedge	Summer perennial	Sedge
Careless weed (pigweed)	Summer annual	Broadleaf
Red stem filaree	Winter annual	Broadleaf
Goosegrass	Summer annual	Grass

Table 7. Partial List of Common Herbicides for Control of Weeds in Turfgrass in Home Lawns. ***Trade names are constantly changing. Look for common names on herbicide labels.***

Common Name	Trade Names	Turfgrasses	Pre/Post	Weeds Controlled
1. Dithiopyr	Sta-Green Crab Ex Green Light Crabgrass Preventer Vigoro Ultra Turf Pre-Emergent Crabgrass and Weed Control	KB, PR, TF Ber, Zoy	pre	annual bluegrass, crabgrass, barnyardgrass, sandburs, green foxtail, chickweed, henbit, purslane, spotted spurge
2. Pendimethalin	Scotts Halts Crabgrass Preventer	KB, PR, TF Ber, Zoy, Buff	pre	Annual bluegrass, crabgrass, goosegrass, oxalis, hop clover, chickweed, henbit
3. Benefin + Oryzalin	Green Light Amaze Grass and Weed Preventer XL 2G	TF, PR, Ber, Buff, Zoy	pre	annual bluegrass, crabgrass, foxtails, barnyardgrass, sandburs, chickweed bittercress
4. Benefin + Trifluralin	Hi-Yield Crabgrass Preventer Southern Ag Team Pro	TF, PR, Ber, Zoy	pre	annual bluegrass, crabgrass
5. Oryzalin	Southern Ag Surflan A.S.	TF, Ber, Zoy	pre	annual bluegrass, crabgrass, barnyardgrass chickweed, henbit, purslane, prostrate spurge
6. Isoxaben	Portrait Broadleaf Weed Preventer	KB, PR, TF Ber, Buff, Zoy	pre	Slender aster, common chickweed, henbit, prostrate knotweed, dandelion (seed), annual sow thistle, spotted spurge, yellow woodsorrel and numerous other broadleaf weeds
7. 2, 4-D	2, 4-D Amine No. 4 American 2, 4-D Selective Weed Killer	TF, Ber, Zoy	post	numerous broadleaf weeds
8. 2, 4-D, MCPP, Dicamba	Ace Spot Weed Killer Bayer Advanced Lawns Southern Weed Ferti-lome Weed Out Lawn Weed Killer Green Light Wipe Out Broadleaf Weed Killer Spectracide Weed Stop for Lawns Ortho Weed-B-Gon Hi-Yield Lawn Weed Killer	KB, TF, PR, Ber, Zoy	post	henbit, chickweed, clovers, spotted spurge, annual sowthistle, Carolina geranium, speedwell and over 200 other broadleaf weeds
9. Triclopyr	Ortho Weed-B-Gon Chickweed, Clover and Oxalis Killer Hi-Yield Turflon Ester	KB, TF, PR	post	black medic, clover, curly dock, dandelion, ground ivy, oxalis, wild carrot, wild violet
10. MCPP, 2, 4-D Dicamba (much higher 2,4-D concentrate than in 8)	Ortho Weed-B-Gon Weed Killer Ortho Weed-B-Gon Kills Weeds, Not Lawns Southern Ag Lawn Weed Killer	KB, TF, PR Ber, Buff, Zoy	post	dandelion, clover, chickweed, purslane, spotted spurge, wild carrot, yellow woodsorrel and many other broadleaf weeds
11. 2. 4-D, MCPP, Dicamba + Carfentrazone	Ferti-lome Weed Free Zone	KB, TF, PR, Ber, Buff, Zoy	post	dandelion, chickweed, spurge, clover, dollarweed, knotweed, plantain and many other broadleaf weeds

Common Name	Trade Names	Turfgrasses	Pre/Post	Weeds Controlled
12. 2, 4-D, MCPP, Dicamba + Sulfentrazone	Spectracide Weed Stop 2X for Lawns	KB, TF, PR, Ber, Buf, Zoy	post	bedstraw, black medic, buckhorn plantain dandelion, curly dock, clover, dollarweed, chickweed, spurge, thistle and many other broadleaf weeds
13. 2, 4-D, Triclopyr, Dicamba	Bonide Chickweed, Clover and Oxalis Killer Ortho Weed-B-Gon Max	KB, TF, PR, Ber, Zoy	post	dandelion, chickweed, clover, ground ivy oxalis, wild violets and many other difficult to control broadleaf weeds
15. Imazaquin	Ambrands Image	Ber, Zoy	post	wild onion/garlic, sedges, sandburs, black medic, common chickweed, henbit, white clover and numerous other broadleaf weeds
16. Bentazon	Monterey Nihilator Southern Ag Basagran Sedge Control	KB, TF, PR, Ber, Buff, Zoy	post	annual sedges, yellow nutsedge, Canada thistle, dandelion, spurge, yellow woodsorrel and numerous other broadleaf weeds

Turfgrass Key: KB=Kentucky bluegrass, TF=tall fescue, PR=Perennial ryegrass, Ber=Bermudagrass, Buff=Buffalograss and Zoy=Zoysiagrass

Note: The information given herein is for educational purposes only. References to commercial products or trade names are made with the understanding that no discrimination or endorsement is intended.

Always read the label and follow manufacturer's recommendations and precautions on all product labels before purchasing, applying, storing or disposing of the herbicide.

Table 8. Partial List of Insecticides for Insect Control in Home Lawns.

Common Name	Insect*	Trade Names (partial list)
1. Azadirachtin	wg, sw, cw, aw	Neemix 4.5
2. Bifenthrin	aw, cw, sw, cb	Ortho Bug-B-Gon Max Insect Killer for Lawns High-Yield Bug Blaster Turf Insect Control Granules
3. Carbaryl	wg, sw, aw, cw, cb, faw	GardenTech Sevin Lawn Insect Granules
4. Deltamethrin	aw, cw, sw, cb, faw	Bonide Delta Eight Insect Control Hi-Yield Turf Ranger Insect Control Granules
5. Halofenozide	wg, sw, aw, faw	Hi-Yield Kill-A-Grub
6. Imidacloprid	wg, cb, cw	Bonide Annual Grub Beater Bayer Advanced Season-Long Grub Control Granules Hi-Yield Grub Free Zone II Spectracide Grub Stop Once & Done
7. Imidacloprid + beta + cyfluthrin	aw, cw, sw, wg, cb	Bayer Advanced Complete Insect Killer *(ready-to-spray, concentrate, granules)*
8. Lambda cyhalothrin	sw, cw, aw	Spectracide Triazicide Insect Killer Once & Done *(ready-to-use, concentrate, granules)*
9. Permethrin	aw, cw, sw, cb, faw	Bonide Total Pest Control-Outdoor Green Light Lawn Killer Hi-Yield Kill-A-Bug II Lawn Granules
10. Trichlorfon	wg, cw, sw, aw	Bayer Advanced 24-Hour Grub Killer Plus Hi-Yield Dylox 6.2 Granular Insecticide

Insect Key: wg=white grub, sw=sod webworm, cw=cutworm, aw=armyworm, cb=chinch bug, faw=fall armyworm

Table 9. Partial List of Fungicides for Disease Control in Home Lawns.

Common Name/Type	**Trade Names (brand name in parenthesis)**
1. Myclobutanil	Spectracide Immunox Multi-Purpose Fungicide Spectracide Immunox Lawn Disease Control Green Light Fung-Away Systemic Lawn Fungicide Granules Ferti-lome F-Stop Spectracide Immunox Plus Schultz Fungicide Plus Concentrate
Myclobutanil combination product	
2. Propiconazole	Ferti-lome Liquid Systemic Fungicide Bonide Infuse CSI Honor Guard PPZ Monterey Fungi-Fighter
3. Thiophanate-methyl	Green Light Systemic Fungicide Ferti-lome Halt Systemic Fungicide Scotts Lawn Fungus Control
4. Triadimefon	Green Light Fung-Away Systemic Lawn Fungicide Spray RTS Green Light Fung-Away Systemic Fungicide Hi-Yield Lawn Fungicide Granules Bonide Fung-Onil Lawn Disease Control Bayer Advanced Fungus Control for Lawns

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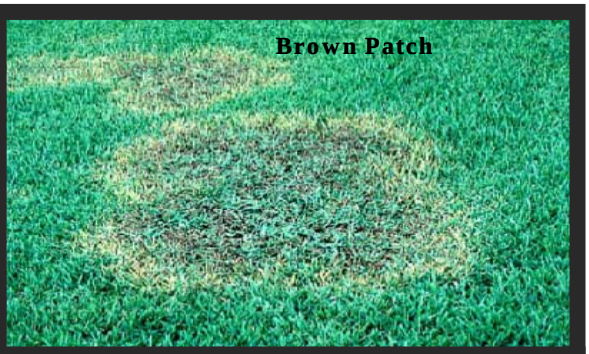
White Grub


Brown Patch


Crabgrass


Nutsedge


Bipolaris Leaf Spot


Field Bindweed


Chinch Bugs

By: Bart Drees


Purslane


Dollar Spot


Henbit