2015 Texas Turfgrass Crop Profile and Pest Management Strategic Plan

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Summary of Priorities for Texas Turfgrasses

Research Priorities	Extension Priorities	Regulatory Priorities
• Continue to conduct research on turfgrass water use and water conservation • Establish Daily Light Integrals for warm-season turfgrasses • Evaluate herbicide options for control of Dallisgrass, King Ranch bluestem, Khakiweed, Sandbur, and Sprangletop • Document herbicide resistance in Annual bluegrass and Goosegrass • Evaluate insecticides for control of Bermudagrass mites and Rhodesgrass mealybugs • Evaluate new products and methods for controlling nematodes • Develop and validate growing degree day models for perennial grass control in Texas • Continue to develop best management practices for salinity, nutrient, and turfgrass management • Continue research on native and non-traditional turfgrass mixtures/plantings	• Re-develop AggieTurf website • Create a Pest Control Recommendations Guide for Texas Turfgrasses • Create an online portal for training county extension agents in turfgrass science and management • Develop extension material for public officials/city leaders, homeowner associations, landscape architects, etc. to ensure they are recommending proper turfgrass species plantings • Create turfgrass management calendars for Texas turfgrasses • Create a turfgrass insect monitoring and alert system	• Turfgrass producers currently use pest control products labeled for turfgrass sites as opposed to agricultural sites even though their public exposure is more similar to traditional agricultural production • Labor issues in regard to legally hiring seasonal and/or migrant workers in turfgrass production • Shipment issues regarding shipping sod through counties in the fire ant quarantine • Interact with public officials to prevent turfgrass planting and species restrictions without the support of scientific research • MSMA use restrictions and current/future status • Turfgrass variety certification programs

2014 Texas Turfgrass Production and Economic Impacts

According to the 2007 Agricultural Census performed by the USDA, turfgrass production industry in Texas ranks 2nd only to Florida in # of farms (164) and acreage (36,805). It also ranked 3rd behind California and Florida in sales, which were approximately $99,564,546 (2007 USDA Census of Agriculture). However, given that this national survey was performed in 2007, prior to a downturn in the national economy, it was important to obtain more current information on Texas Turfgrass Production in 2014.

As a result, a 2014 Texas Turfgrass Producers survey was created and distributed to members of the Turfgrass Producers of Texas (TPT), the state's sole organization that represents the turfgrass production industry in Texas. The survey was created by Dr. Marco Palma (Associate Professor & Extension Economist, Texas A&M), Dr. Casey Reynolds (Assistant Professor & Extension Turfgrass Specialist, TAMU), and Mr. John Cosper (Executive Director of the Turfgrass Producers of Texas) and distributed to TPT members during the summer of 2014.

Net sales data from the survey was used to estimate total economic contributions of the sod Industry to the Texas Economy. To evaluate the economic impact contributions of the green industry to the Texas economy, economic models were developed using the Implan software system and associated Texas datasets (MIG, 2014). The Implan system includes more than 500 industries. Input-Output models represent the structure of a regional economy in terms of transactions, employees, households, and government institutions (Miller & Blair, 1985).

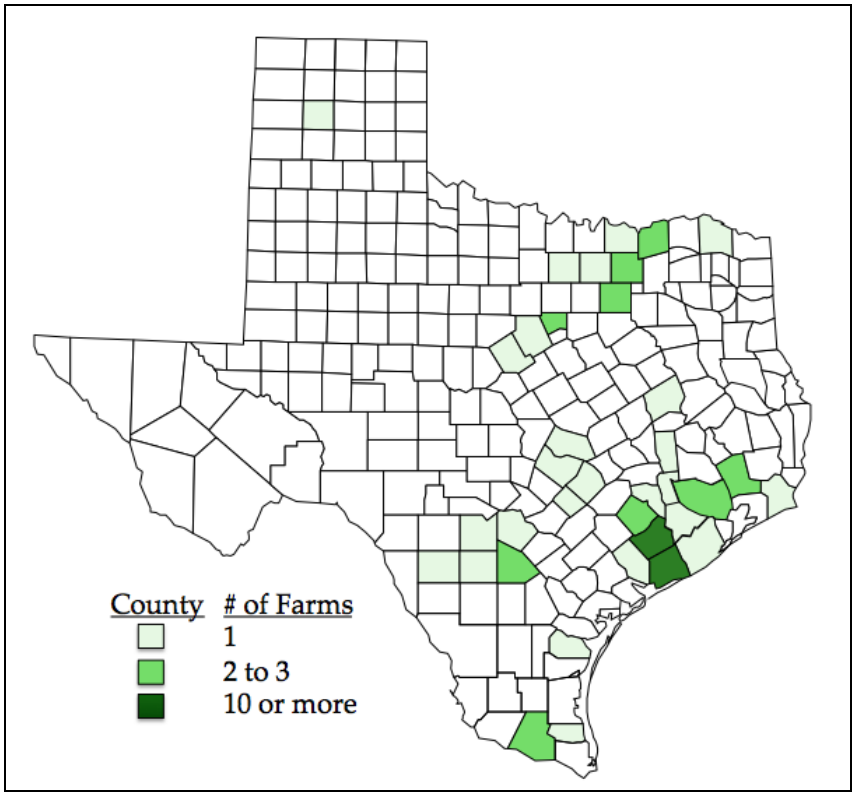
The economic multipliers derived from the Implan model were used to estimate the total economic activity generated in the state by sales (output) to final demand or exports. This includes the effects of intermediate purchases by sod industry firms from other economic sectors (indirect effects) and the effects of sod industry employee household consumer spending (induced effects), in addition to direct sales by industry firms.

The total economic contributions of the Texas Turfgrass Production Industry were estimated at $263.2 million in output; 2,128 jobs, and $161.2 million in value added to the Texas state economy. The average gross sales value of the firms who responded to the survey was $2,123,958, with a minimum value of less than $100,000 and a maximum value of more than $10,000,000. Half of the operations had gross sales between $1,000,000 and $4,999,999 (50%), followed by $250,000-$499,999 (17%). Using a stratified sampling method of this survey, we estimate total sales of the turf grass industry in Texas to be $120,800,000.

Turfgrass production occurs in at least 35 counties in Texas with the bulk of the production located in the Southeast corner of the state (Figure 1). Production in central and southern parts of the state is exclusively warm-season species (St.

Augustinegrass, Bermudagrass, Zoysiagrass, Centipedegrass, Buffalograss, and Seashore Paspalum) while production in the northern and western parts of the state are more likely to include cool-season species (Kentucky bluegrass and Tall fescue).

Figure 1. 2014 Turfgrass Production in Texas Counties

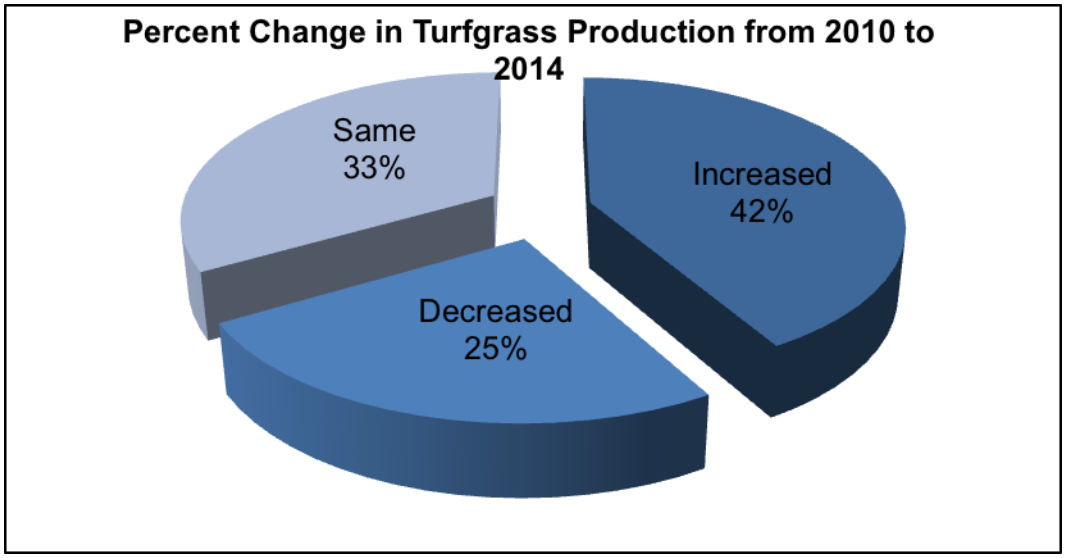


*This map was created using the 2014 Turfgrass Producers of Texas Membership Directory.

In 2014, there were approximately 19,282 acres of turfgrass in production in Texas, which is a 9.8% increase from 17,378 acres in 2013. An analysis of planting data from 2010 to 2014 reveals that turfgrass production acreage is dependent upon the producer (Figure 2). About one in every three respondents (33%) reported to have the same production in their operation compared to 2010 while one quarter (25%) of the farmers have reduced their production in the same period. The remaining 42% of respondents have increased their production from 2010. When asked about operating expenses from 2012 to 2014, 75% of respondents said their expenses have increased (ranging from 14 to 45%) while the remaining 25% of respondents said their expenses were about the same.

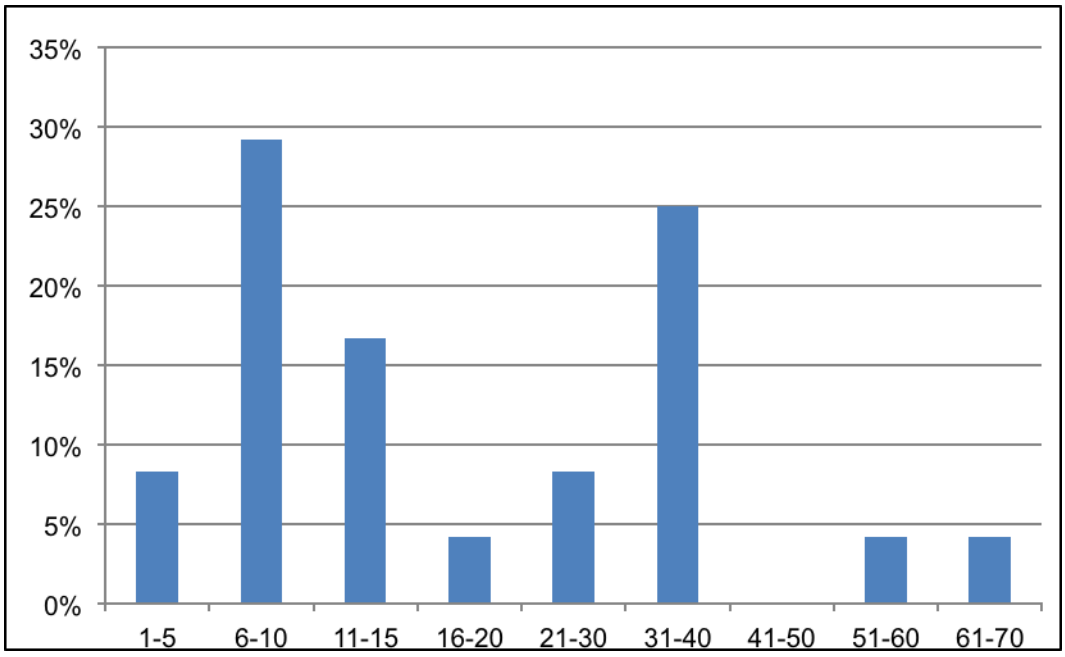
When respondents were asked about their plans to increase or decrease turfgrass production acreage in 2015, approximately 50% said they planned to increase production while the other 50% planned to remain the same. Furthermore, from those planning to increase acreage, the average expected increase was 30%, yet some respondents plan to double their acreage in 2015.

Figure 2. Percent Change in Turfgrass Production from 2010 to 2014.



The average number of years that turfgrass production firms have been in business in Texas is 22 years. The distribution of years in operation indicates that the majority of respondents were in business between 6-10 years, followed by 31-40 years, then 11-15 years (Figure 3).

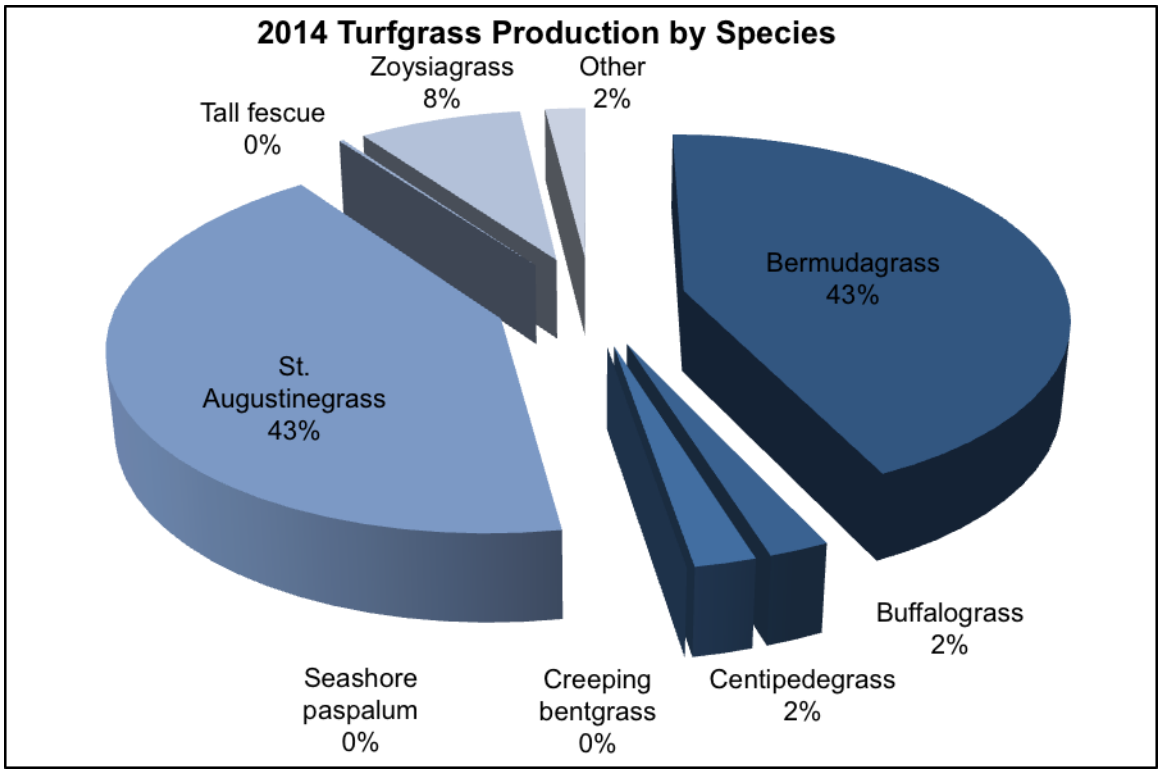
Figure 3. Turfgrass Production Firm's Number of Years in Business.



The results from Figure 4 illustrate that the most popular species currently in turfgrass production are bermudagrass and St. Augustinegrass, both with 43% of the production among respondents. This was followed by zoysiagrass with 8%,

while Buffalo, Centipede and other varieties not listed represent 2% each of the remaining varieties planted. Seashore paspalum, creeping bentgrass and tall fescue are not currently being produced by any of the respondents in the survey.

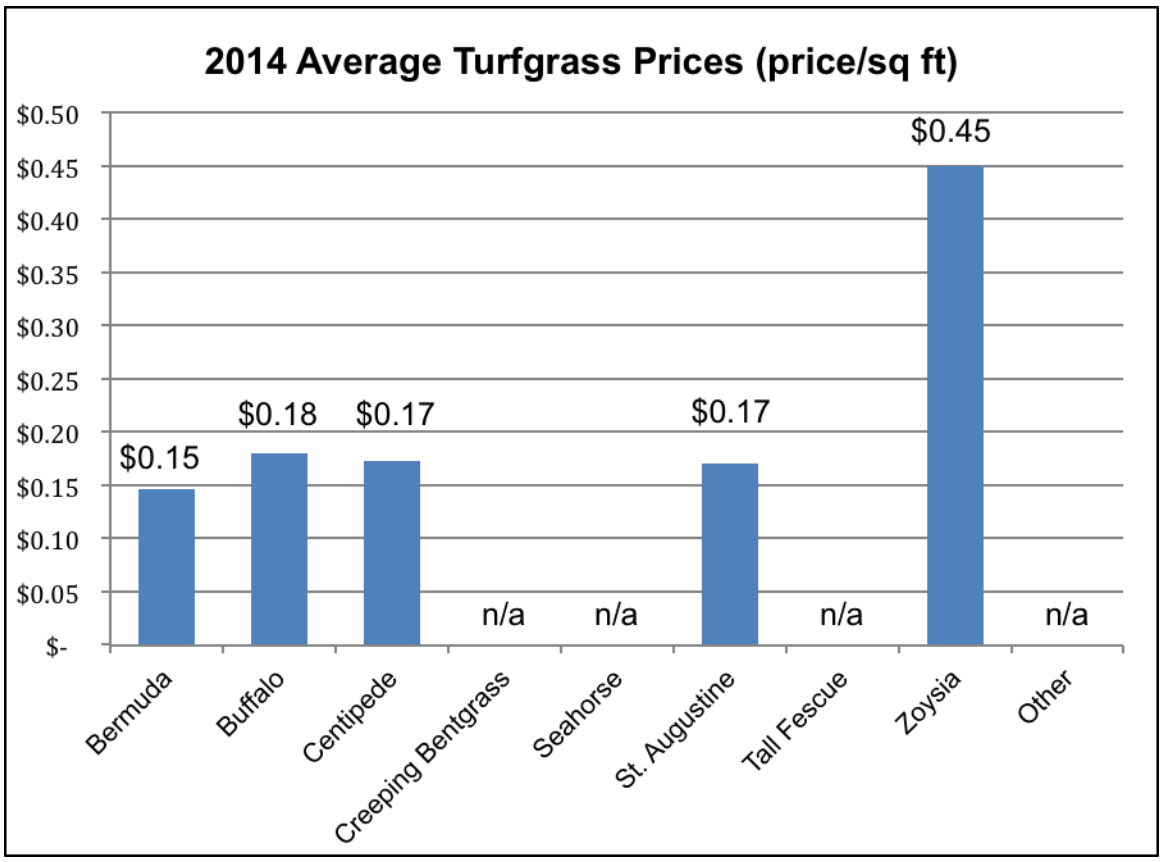
Figure 4. 2014 Turfgrass Production by Species



In regard to prices, the average price per square foot of turfgrass varies by species as indicated in Figure 5. Zoysiagrass has the highest average reported price of \$0.45/ft^2 while the more popular species, bermudagrass and St. Augustinegrass, sell for \$0.15 and \$0.17/ft^2 respectively. Buffalograss sells on average for \$0.18/ft^2 and Centipedegrass averages \$0.17/ft^2. Since none of the respondents reported currently producing any of the other species, no reported price information is available.

There can also be variations in price based on varieties within species, but this data was not collected from producers as part of this survey. Varieties and prices change routinely in the market and the authors of the survey did not feel this was a major component of the information collected.

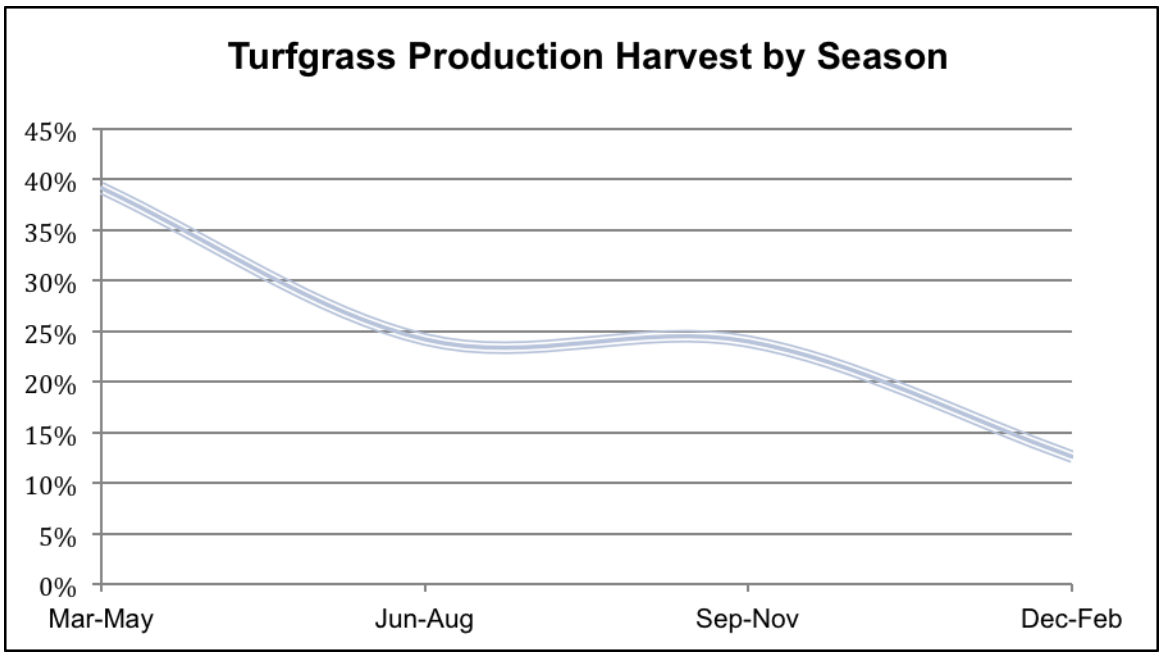
Figure 5. 2014 Average Turfgrass Species Prices (price/sq ft)



As with many other agricultural commodities, turfgrass production harvests varies by season (Figure 6). When describing the proportion of turfgrasses harvested in Texas, respondents' answers show a clear trend of the seasonality of harvest. According to the results in Fig. 6, the period between March and May is the peak harvest season with almost 40% of the total amount of turfgrass produced being harvested during this time. Inversely, December thru February is the lowest point of harvest with less than 15% occurring during this time, while the months between June and November comprise the remainder.

Generally speaking, turfgrass can be harvested and planted anytime during the year as long as the ground is not frozen. There are often situations where builders and other customers purchase and plant sod during the winter months while warm-season sod is dormant, but many customers prefer to plant during the spring months when temperatures are mild and rainfall is more likely. This likely explains the peak harvest in the spring months, followed closely by the summer and fall months, before substantially decreasing during the winter months.

Figure 6. Turfgrass Production Harvest by Season



The seasonal nature of the turfgrass production industry results in the need to supplement full-time labor with seasonal labor. Respondents to the survey indicated that within each of their businesses, approximately 65% of their labor was full-time, 29% of their labor was seasonal, and 6% of their labor was part-time. Furthermore, in the two-year period from 2012 to 2014, 37% of respondents have increased their workforce, while 46% reported no change and 17% reported a decrease in workforce. From the producers that did experience changes in labor hiring in the period between 2012 and 2014, the average increase in workforce was 24%. The highest reduction and the highest increase are both 50% less and 50% more employees, respectively.

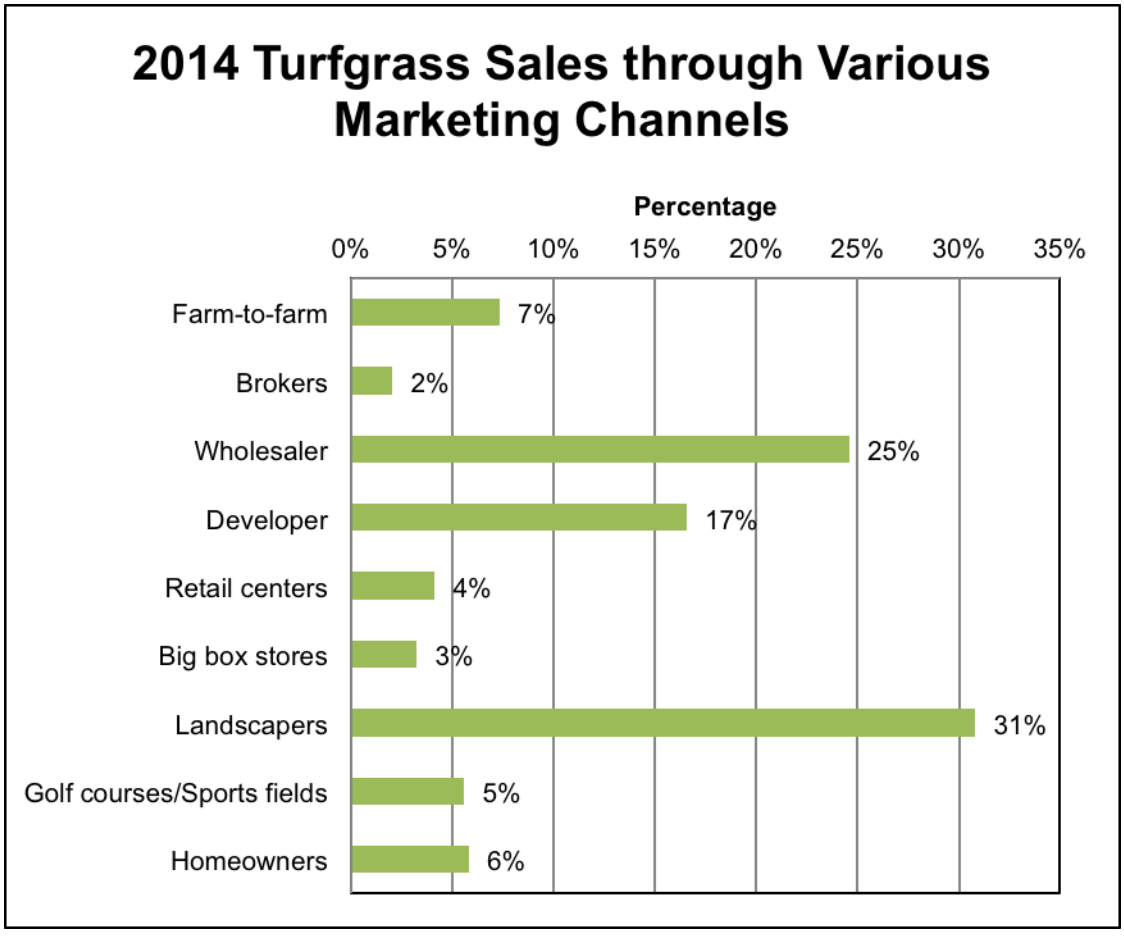
Of the main harvest methods used in turf grass, an almost equal split is seen in Fig. 6 between strip-cut (51%) and clear-cut (49%). Strip-cut is a process used in warm-season turfgrass sod production where during harvest, 2-4” strips of sod are left in the field between harvested strips. This allows the sod to grow back from lateral stems in each strip until the harvested strips are fully grown-in. Clear-cutting removes all of the turfgrass in the field and re-growth occurs exclusively from underground stem tissue until the field is fully grown-in and ready for additional harvests.

After mechanical harvesting, the respondents to this survey indicated that 56% of the sod cut and stacked in Texas during 2014 was done manually, while 33% was stacked using semi-automatic equipment, and 11% was stacked using fully automated equipment. Once the turfgrass is harvested, 84% is packed, sold, and

transported as slabs (16” x 24”), 9% as big rolls (42” x 102”), and 7% as mini-rolls (variable).

Turfgrass producers have many ways to get their product to market, as indicated in Fig. 7. Wholesalers, landscapers, and developers account for almost 75% of the customer-base while brokers, retail centers, big box stores, golf courses, sports fields, and homeowners account for between 2% and 7% each. In terms of how far turfgrass must travel from farm-to-market, approximately 34% of turfgrass travels less than 50 miles to market, 40% travels between 50 and 100 miles, and 26% travels more than 100 miles to get to its final market. Turfgrass producers get their product to market by either owning their own transport or by having a third-party transport it. The respondents in this survey indicated that approximately 58% of them own their own transport while the remaining 42% contract that service out to a third-party.

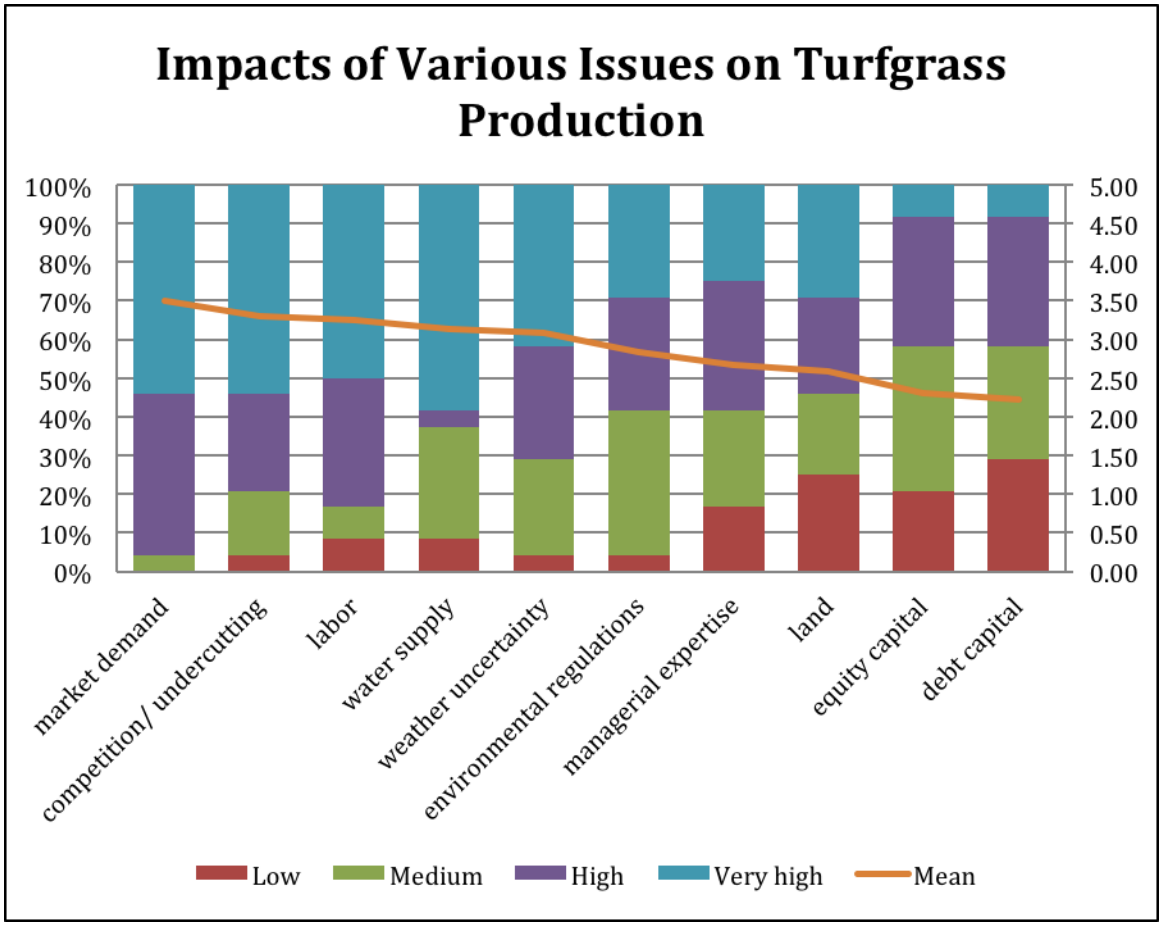
Figure 7. 2014 Turfgrass Sales through Various Marketing Channels. Values represent percentage of total sales in each marketing channel.



The respondents were also asked where in the supply chain their product is most likely to be damaged to the point that its quality is significantly reduced. Their responses were (from beginning to end): in the field (26%); at harvest (19%); during shipping (17%), and at the buyer's location (38%).

In addition to the information above on production and supply chain, the survey also included questions on various factors that may impact production. These include areas such as weather, market demand/pressures, financial pressures, regulatory pressure, water supply, and others. Figures 8 and 9 illustrate the producers' feelings about these various issues and they may impact production.

Figure 8. Impacts of Various Issues on Turfgrass Production



Turfgrass producers were asked about their feelings regarding which of the issues in Figure 8 had the largest impact on their production practices. The left-hand Y-axis represents the percentage of total responses in each of the low, medium, high, and very high categories while the right-hand Y-axis represents the means of their responses, which could range from 1 to 4.

Market demand was by far the most important factor in turfgrass producers' attitudes towards production (3.50) while other important factors were competition (3.29), cost of labor (3.25), water supply (3.13), and uncertainty in the weather (3.08). Factors considered between high and medium were: environmental regulations (2.83), managerial expertise (2.67), and cost of land (2.58). Factors considered between medium and low were: the cost of equity capital (2.29) and debt capital (2.21).

Figure 9. Impacts of Various Issues on Turfgrass Production

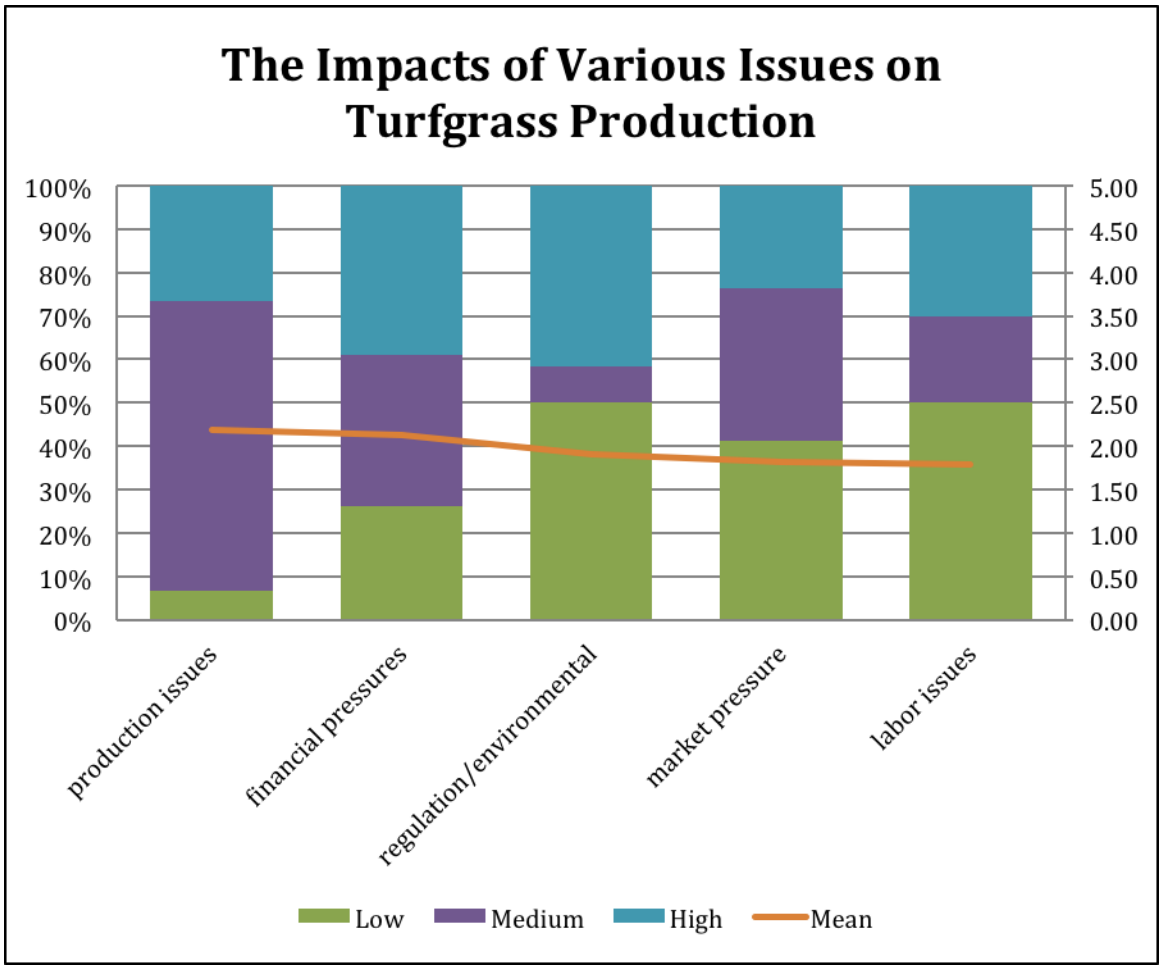


Figure 9 is similar to Figure 8 except that the scale of possible responses only ranged from 1 to 3, instead of 1 to 4 as in Figure 8. Respondents indicated the issues that contribute highly or very highly to the success or failure in the sod industry were: production issues (2.20) and financial pressures (2.13). The factors considered between high and medium were government and environmental regulations (1.92) market pressure (1.82) and labor issues (1.80). There were no factors with a mean response between medium and low.

Turfgrass Production Cultural Practices

Mowing

Turfgrass sod in production fields is routinely mowed to encourage lateral growth, adequate density, and finer leaf texture. A combination of reel-mowers and rotary mowers are used with the selection of each being species dependent. Reel-mowers are more commonly used on bermudagrass and fine-textured zoysiagrasses, especially those grown at lower heights for sale to golf courses and athletic fields. Rotary mowers are more commonly used on turfgrasses grown at higher mowing heights such as St. Augustinegrass, Centipedegrass, etc. For specific information on recommended mowing heights, see the "Turfgrass Profile" for each specific species. Mowing frequency depends on height of cut with the lower-mowed turfgrasses being mowed more frequently than higher-mowed turfgrasses. It also depends on harvest date in that turfgrasses closer to being harvested are typically mowed more frequently (3-4 times per week) than turfgrasses in the early stages of grow-in (1-2 times per week).

Weed Control

Herbicides are most commonly applied using tractor-mounted boom sprayers. However, on a small scale, it is also common for herbicides to be applied using a small sprayer mounted on a utility vehicle or a backpack sprayer. Frequency of application depends on time of year with the majority of applications being made during spring and fall months to target various annual weed species using a combination of pre-emergence and post-emergence herbicides. Hand-weeding occasionally occurs immediately prior to harvest and sale, in sensitive species, or during times when equipment cannot enter fields due to excessive moisture. Further information on turfgrass weed control in sod production is included in the section titled "Turfgrass Weed Control Recommendations", included in this document. Problematic weeds have been identified in Table 14.

Insect Control

Insecticides are most commonly applied on an as-needed basis using similar spray equipment as listed under Weed Control. Some turfgrass producers treat preventively for insects such as White grubs or Hunting billbugs if they have a history of them on their facility. However, the bulk of these applications are sprayed curatively. Further information on turfgrass insect control in sod production is included in the section titled "Turfgrass Insect Control Recommendations", included in this document. Problematic turfgrass insects have been identified in Table 19.

Disease Control

Fungicides are most commonly applied on an as-needed basis using similar spray equipment as listed under Weed Control. Some turfgrass producers treat preventively for specific diseases in high-value sod, or for diseases that are likely to occur due to weather patterns, history of infestation, or particularly susceptible

turfgrasses. These applications are made as needed at any point during the growing season, but are most likely during hot, humid weather, periods of rainfall, or the fall months when warm-season grasses are particularly susceptible to disease activity. Further information on turfgrass disease control in sod production is included in the section titled “Turfgrass Disease Control Recommendations”, included in this document. Problematic turfgrass diseases have been identified in Table 22.

Irrigation

Analysis of historical precipitation patterns in Figure 10 illustrates the east-to-west gradient of diminishing rainfall throughout Texas.

Figure 10. Average Annual Precipitation (inches) from 1981 to 2010

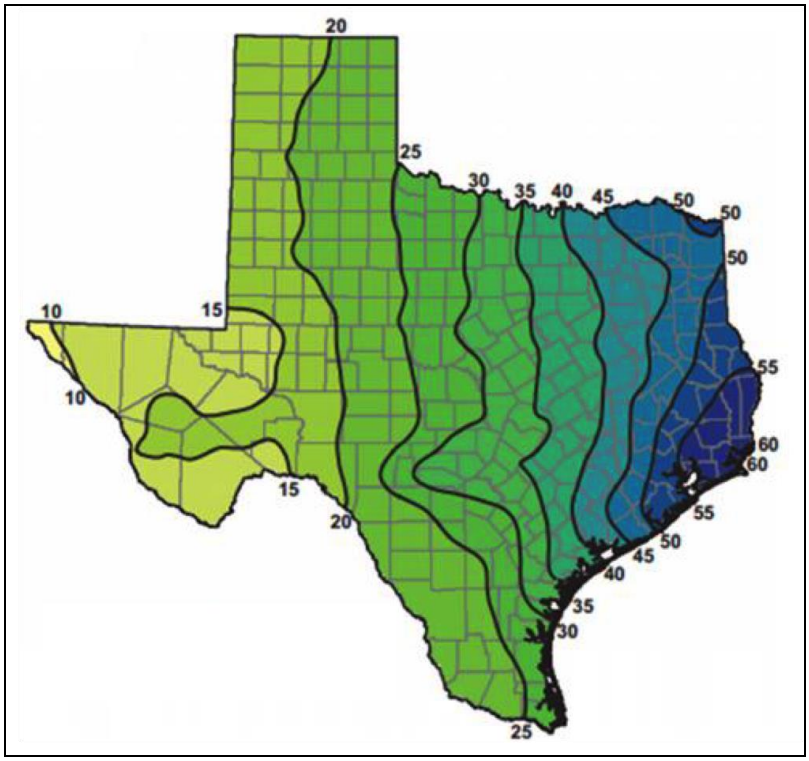
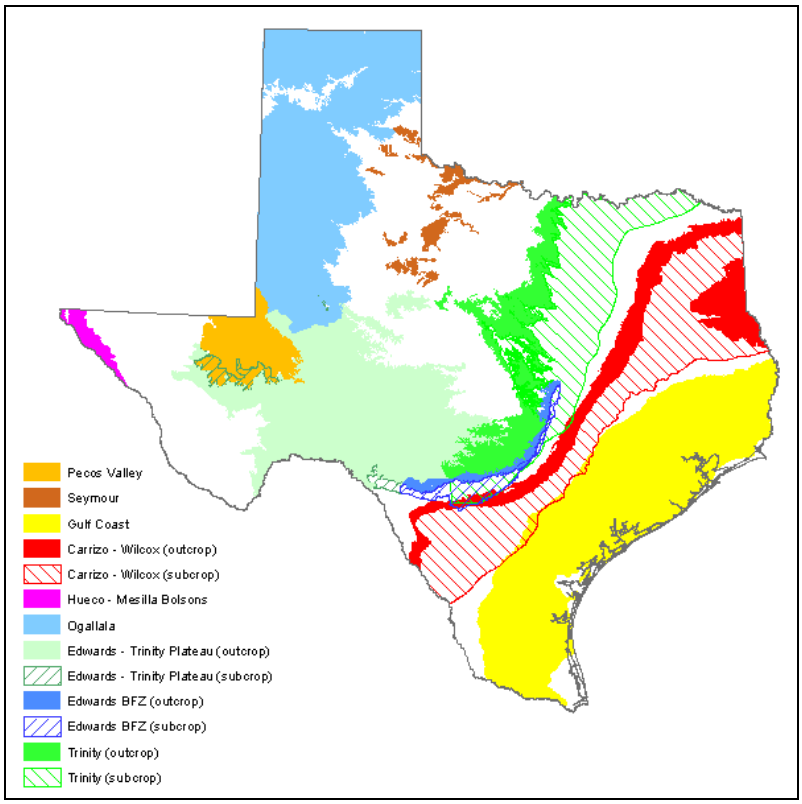


Figure courtesy of Robert B. Shaw, “Guide to Texas Grasses”

As a result, supplemental irrigation using overhead systems is often required for successful establishment and maintenance of turfgrass sod. Overhead irrigation using a combination of center-pivot systems, side-roll systems, lateral systems, and/or hand-line systems is the predominant method used for irrigation. Water sources can include groundwater (Figure 11), rivers, and/or holding ponds.

Figure 11. Major Aquifers of Texas



Full-size image available at http://www.twdb.state.tx.us/groundwater/aquifer/major.asp

Land Preparation and Planting

Newly established turfgrass production fields are treated with a non-selective herbicide, cultivated using disc or tillage equipment, leveled, and then sprigged or plugged depending on species and variety. After a field has been initially established, it is re-established after harvest by allowing re-growth from rhizomes and/or small 4-6" strips that are left between harvested areas.

Harvesting

Traditional slab harvesters that consist of a tractor-mounted harvester and manual pallet stacker are the most frequently used during harvest. They consist of one employee driving the tractor while the sod is being harvested and at least one employee on the back of the tractor stacking the sod onto the pallet. Auto-stackers are less frequent, but occasionally used in larger, more elaborate operations. Slabs of sod are harvested and sold in various sizes, depending on equipment. These sizes often include: Short slabs (16" x 24"), Long slabs (16" x 42"), Mini-rolls (variable), Big rolls (42" x 102').

Other worker activities

Aeration, rolling using a drum-type roller pulled behind a tractor, removing water after heavy rains using hand-pumps.

Turfgrass Profiles

Turfgrass profiles were created for each major turfgrass species produced and managed in Texas and includes information on the following:

Latin Name:

Growth Habit:
Vernation:
Leaf:
Ligule:
Auricles:
Inflorescence:

Areas of Adaptation: See maps

Description:
Strengths:
Weaknesses:
Recommended Mowing Height:
Recommended Mowing Frequency:
Fertilization Requirements:

Available Varieties in Texas: This list was created using the 2014 Turfgrass Producers of Texas (TPT) website www.txsod.com which lists all of the varieties currently produced by TPT members.

Turfgrass Profile: Bermudagrass

Latin Name: *Cynodon dactylon* L. Pers and *Cynodon dactylon* (L.) Pers x *Cynodon transvaalensis* Burtt Davy

Growth Habit: Rhizomatous and Stoloniferous
Vernation: Folded
Leaf: Smooth or hairy on both surfaces
Ligule: Fringe of hairs
Auricles: Absent
Inflorescence: Panicle with 2-9 spicate branches arranged in a digitate manner at the apex of the culm

Figure 12. Bermudagrass Areas of Adaptation

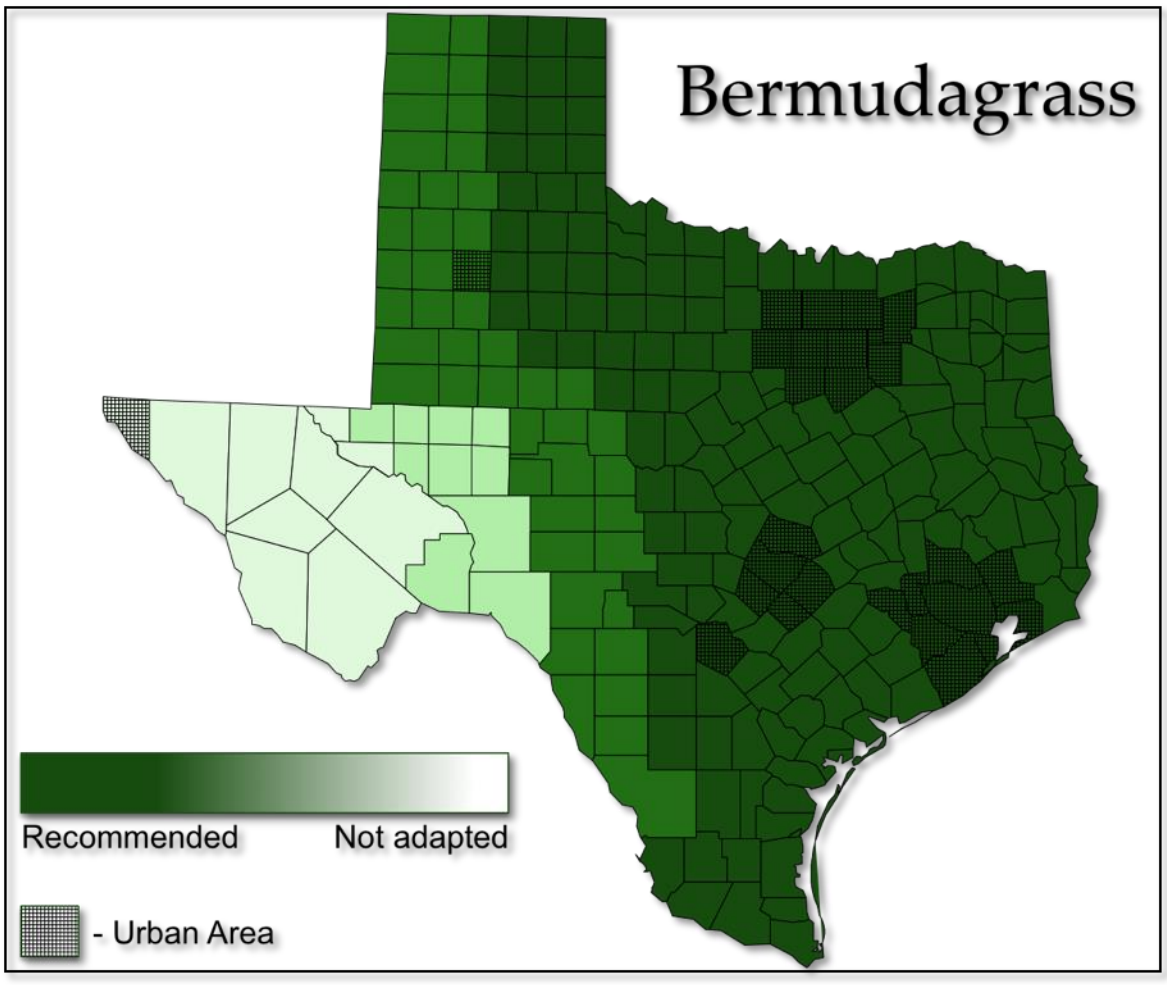


Table 1. Available Bermudagrass Varieties in Texas		
Vegetatively Propagated Varieties		
Variety	Latin Name	Availability
Baby	*Cynodon dactylon* (L.) Pers.	Sod
Celebration	*Cynodon dactylon* (L.) Pers.	Sod/Sprigs
GN-1	Cynodon dactylon (L.) Pers.	Sod/Sprigs
Discovery	Cynodon dactylon (L.) Pers.	Sod/Sprigs
Emerald Dwarf	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Grimes EXP	Cynodon dactylon (L.) Pers.	Sod/Sprigs
Latitude 36	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Midiron	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Northbridge	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Patriot	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Premier	*Cynodon dactylon* (L.) Pers.	Sod/Sprigs
Quickstand	*Cynodon dactylon* (L.) Pers.	Sod/Sprigs
Texas Native	*Cynodon dactylon* (L.) Pers.	Sod/Sprigs
Texas Turf 10	*Cynodon dactylon* (L.) Pers.	Sod/Sprigs
Tifton 10	*Cynodon dactylon* (L.) Pers.	Sod/Sprigs
TifGrand	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Tifsport	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Tifway II	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Tifway 419	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
U3	*Cynodon dactylon* (L.) Pers.	Sod/Sprigs
Ultra-dwarf Varieties		
Variety	Latin Name	Availability
Champion	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
Mini-verde	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
TifDwarf	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
TifEagle	*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs
TifGreen	*Cynodon dactylon* (L.) Pers x *Cynodon transvaalensis* Burtt Davy	Sod/Sprigs

Seeded Varieties		
Variety	Latin Name	Availability
Arizona Common	*Cynodon dactylon* (L.) Pers.	Seed
Barbados	*Cynodon dactylon* (L.) Pers.	Seed
Casino Royal	*Cynodon dactylon* (L.) Pers.	Seed
Contessa	*Cynodon dactylon* (L.) Pers.	Seed
Dune	*Cynodon dactylon* (L.) Pers.	Seed
Hollywood	*Cynodon dactylon* (L.) Pers.	Seed
Jackpot	*Cynodon dactylon* (L.) Pers.	Seed
LaPaloma	*Cynodon dactylon* (L.) Pers.	Seed
Mirage 2	*Cynodon dactylon* (L.) Pers.	Seed
Mohawk	*Cynodon dactylon* (L.) Pers.	Seed
Numex Sahara	*Cynodon dactylon* (L.) Pers.	Seed
Panama	*Cynodon dactylon* (L.) Pers.	Seed
Princess 77	*Cynodon dactylon* (L.) Pers.	Seed/Sod
Pyramid 2	*Cynodon dactylon* (L.) Pers.	Seed
Riviera	*Cynodon dactylon* (L.) Pers.	Seed
Sahara	*Cynodon dactylon* (L.) Pers.	Seed
Southern Star	*Cynodon dactylon* (L.) Pers.	Seed
Sovereign	*Cynodon dactylon* (L.) Pers.	Seed
Sultan	*Cynodon dactylon* (L.) Pers.	Seed
Sunbird	*Cynodon dactylon* (L.) Pers.	Seed
Sundevil II	*Cynodon dactylon* (L.) Pers.	Seed
Sunsport	*Cynodon dactylon* (L.) Pers.	Seed
Sunstar	*Cynodon dactylon* (L.) Pers.	Seed
Sydney	*Cynodon dactylon* (L.) Pers.	Seed
Transcontinental	*Cynodon dactylon* (L.) Pers.	Seed
Veracruz	*Cynodon dactylon* (L.) Pers.	Seed
Yukon	*Cynodon dactylon* (L.) Pers.	Seed

Description: Bermudagrass is a warm-season, fine-textured turfgrass that spreads laterally by rhizomes and stolons. It is an extremely drought-hardy, durable, and versatile turfgrass that can be used in many settings included golf courses, athletic fields, home lawns, and as utility turf. It is relatively quick to establish by seed or sprigs and is most notably known for its superior traffic tolerance and quick recuperative potential. These facts, combined with its tolerance to low mowing heights, make it ideal for golf course and athletic turf as well as any other areas that may be heavily trafficked.

Common bermudagrass (*Cynodon dactylon* (L.) Pers.) varieties often have coarse leaf texture and light green color. However, improvements in common bermudagrass appearance have been achieved through breeding efforts and there are many improved varieties available on the market that have

finer leaf texture, darker color, and improved density. These varieties are most often planted by seed, but some improved varieties are also sold as sod (Princess, for example).

In addition to seeded varieties of *Cynodon dactylon* (L.) Pers., there are also hybrid bermudagrasses available that can be planted as sod or sprigs. These varieties are most commonly crosses between common bermudagrass (*Cynodon dactylon* (L.) Pers.) and African bermudagrass (*Cynodon transvaalensis* Burtt Davy). The resulting progeny of these crosses often have superior aesthetics including fine leaf texture, improved density, dark green color and are typically the preferred choice for golf courses, athletic fields, and some home lawns. However, seed of these interspecific crosses is often sterile, and therefore hybrid bermudagrass varieties must be planted vegetatively by sod or sprigs. This is also the case with the ultradwarf varieties, which are most commonly used on golf course putting greens due to their ability to tolerate extremely low mowing heights (≤0.125 inches).

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

Weaknesses: Shade tolerance, frequent mowing requirement and a moderate to high fertilization requirement.

Recommended Mowing Height: Home Lawns: 1-2 inches; Golf and Athletic Turf: 0.75 to 1 inch; Ultra-dwarfs: < 0.25 inches.

Recommended Mowing Frequency: Home Lawns: Weekly using a rotary mower; Golf and Athletic Turf: Daily to weekly using a rotary or reel mower; Putting Greens: Daily using a reel mower.

Fertilization Requirements: 0.5 to 1 lb N per 1,000 ft^2 month during the summer growing season; 3 to 6 total lbs N per 1,000 ft^2 per year.

Turfgrass Profile: Buffalograss

Latin Name: (*Bouteloua dactyloides* (Nutt.) J.T. Columbus)

Growth Habit: Stoloniferous
Vernation: Rolled
Leaf: Hairs on both surfaces; Ridges on upper surface
Ligule: Fringe of hairs
Auricles: Absent
Inflorescence: Staminate and pistillate spikelets in separate inflorescences; usually on different plants. Staminate spikelets in 1-4 spicate infloresences; Pistillate spikelets in 2-4 burlike clusters.

Figure 13. Buffalograss Areas of Adaptation

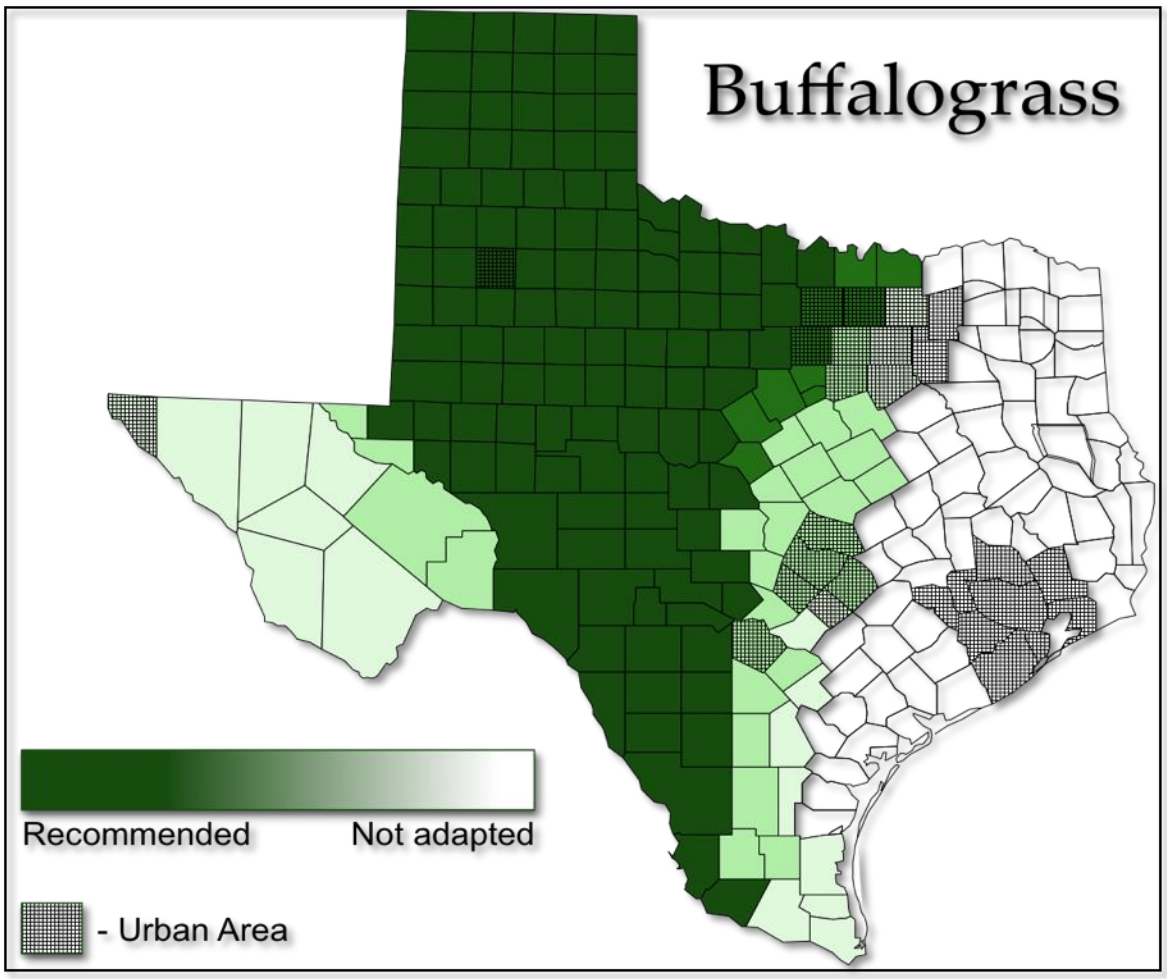


Table 2. Available Buffalograss Varieties in Texas		
Variety	Latin Name	Availability
609	(*Bouteloua dactyloides* (Nutt.) J.T. Columbus)	Seed/Sod
Density	(*Bouteloua dactyloides* (Nutt.) J.T. Columbus)	Sod
Prairie	(*Bouteloua dactyloides* (Nutt.) J.T. Columbus)	Sod
Prestige	(*Bouteloua dactyloides* (Nutt.) J.T. Columbus)	Sod

Description: Buffalograss is a warm-season, native turfgrass that spreads laterally by rhizomes and is best suited as a low-input, low-use turfgrass. It is unique from other turfgrasses in that it has male (staminate) and female (pistillate) flowers on separate inflorescences. These are usually present on different plants (dioecious) but can also be found on the same plant (monecious).

Strengths: Drought tolerance, cold tolerance, low disease potential, low mowing requirement, and low fertilization requirement.

Weaknesses: Shade tolerance, salinity tolerance, and traffic tolerance. It also does not do well in east Texas where there is higher annual rainfall relative to central and west Texas.

Recommended Mowing Height: Home Lawns: 2.5 to 4 inches; Golf Courses: 1-2 inches; Natural areas: ≥ 4 inches or un-mowed.

Recommended Mowing Frequency: Every 7-14 days using a rotary mower

Fertilization Requirements: 0 to 2 lbs of N per 1,000 ft^2 per year applied during the summer growing season. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2.

Turfgrass Profile: Centipedegrass

Latin Name: *Eremochloa ophiuroides* (Munro) Hack.

Growth Habit: Stoloniferous
Vernation: Folded
Leaf: Flat, smooth on both surfaces, tip moderately-pointed to blunt
Ligule: Membranous with short hairs
Auricles: Absent
Inflorescence: Spikelike raceme

Figure 14. Centipedegrass Areas of Adaptation

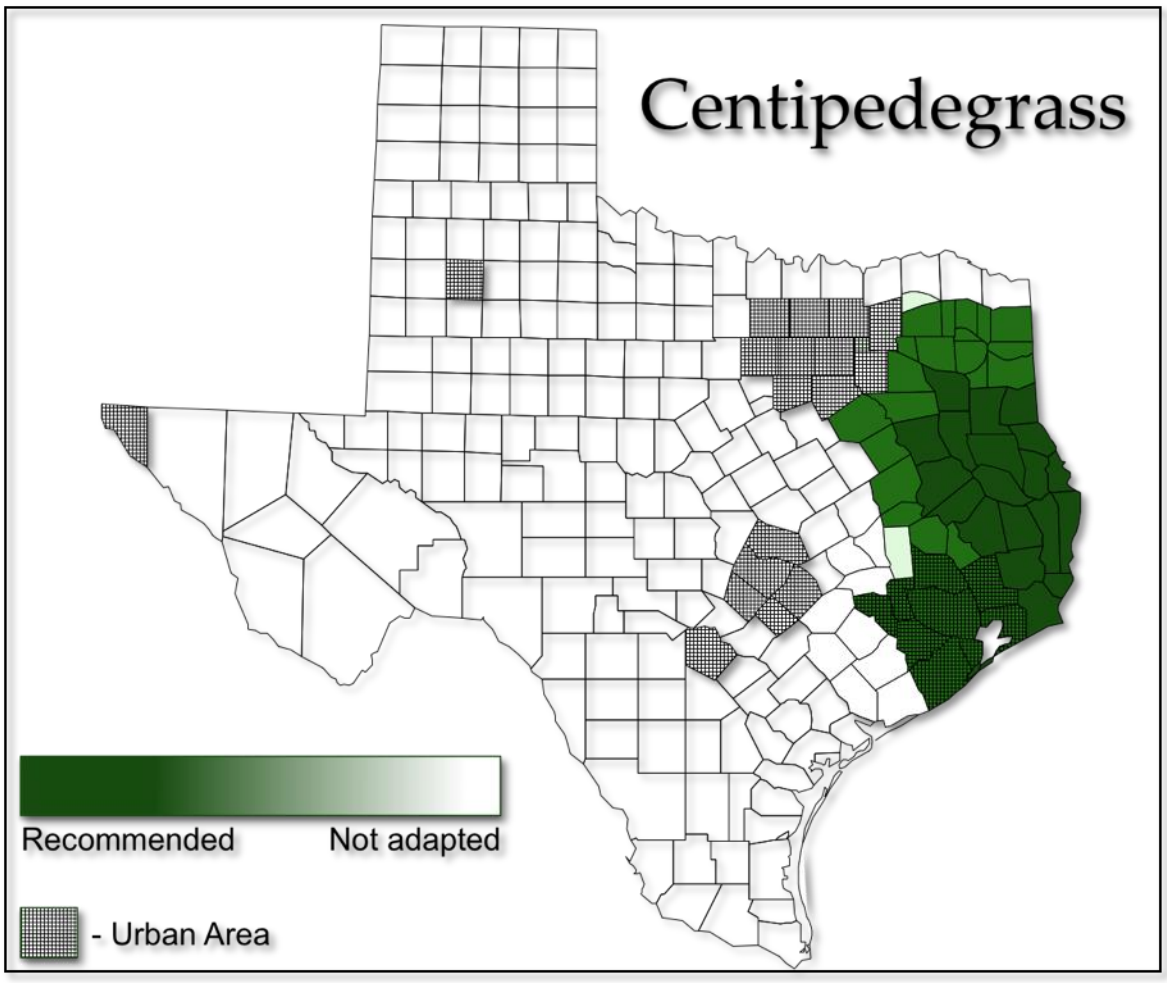


Table 3. Available Centipedegrass Varieties in Texas		
Variety	Latin Name	Availability
Common	*Eremochloa ophiuroides* (Munro) Hack.	Sod
Covington	*Eremochloa ophiuroides* (Munro) Hack.	Sod
Hammock	*Eremochloa ophiuroides* (Munro) Hack.	Sod
Santee	*Eremochloa ophiuroides* (Munro) Hack.	Sod
TifBlair	*Eremochloa ophiuroides* (Munro) Hack.	Seed/Sod

Description: Centipedegrass is a low-input, warm-season turfgrass that spreads by stolons. It typically performs best in acidic soils found in East Texas and is best known for its low maintenance requirements with regard to mowing, fertilization, and irrigation. However, it does not do well in shade or traffic and is often sensitive to many commercially available herbicides.

Strengths: Low mowing and fertilization requirement, low to moderate disease potential, and performs well in acidic soils.

Weaknesses: Cold tolerance, shade tolerance, traffic tolerance and herbicide injury. High disease potential if over-fertilized and/or over-watered.

Recommended Mowing Height: 1.5 to 2 inches

Recommended Mowing Frequency: Weekly using a rotary mower

Fertilization Requirements: 1 to 2 lbs of N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the summer growing season.

Turfgrass Profile: Seashore paspalum

Latin Name: *Paspalum vaginatum* Sw.

Growth Habit: Rhizomatous and Stoloniferous
Vernation: Folded
Leaf: Scattered hairs may be present on upper and lower surface
Ligule: Short, membranous
Auricles: Absent
Inflorescence: Panicle with paired, terminal branches and 1 to many spikelike branches

Figure 15. Seashore paspalum Areas of Adaptation

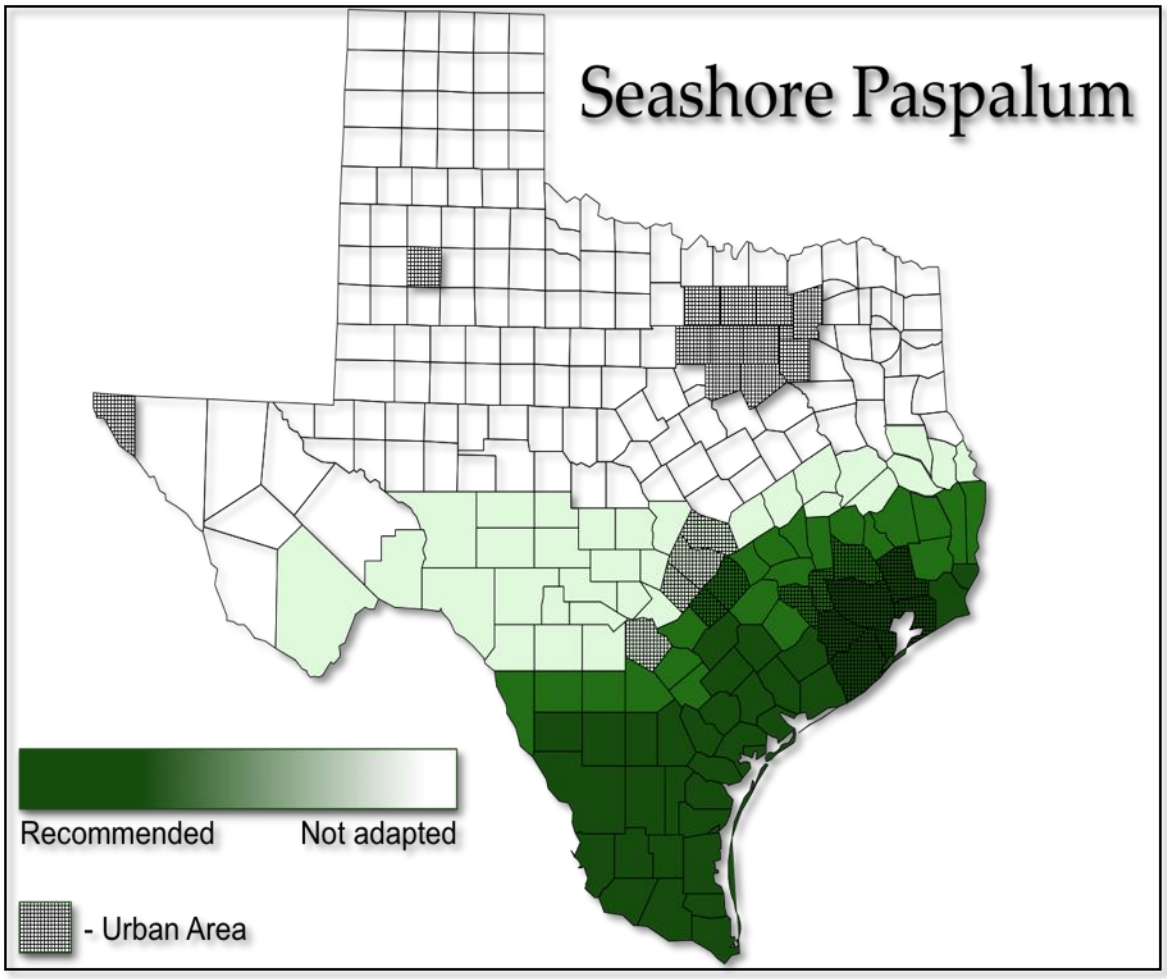


Table 4. Available Seashore paspalum Varieties in Texas		
Variety	Latin Name	Availability
Aloha	*Paspalum vaginatum* Sw.	Sod
Platinum TE	*Paspalum vaginatum* Sw.	Sod
SeaDwarf	*Paspalum vaginatum* Sw.	Sod
SeaIsle	*Paspalum vaginatum* Sw.	Sod
Seaspray	*Paspalum vaginatum* Sw.	Seed

Description: Seashore paspalum is a warm-season turfgrass that spreads by rhizomes and stolons and is very similar to bermudagrass in its appearance and performance. It is most commonly used in areas where salinity is a concern due to proximity to the coast or poor-quality ground water. Relative to bermudagrass, it has higher shade tolerance and less cold tolerance. As a result of its lack of cold tolerance, its use is typically confined to the southern most parts of the country, including south Texas.

Strengths: Salinity tolerance, shade tolerance, and traffic tolerance.

Weaknesses: Cold tolerance and high disease potential

Recommended Mowing Height: Home Lawns: 1-2 inches; Golf and Athletic Turf: 0.75 to 1 inch; Putting Greens: < 0.150 inches.

Recommended Mowing Frequency: Home Lawns: Weekly using a rotary mower; Golf and Athletic Turf: Daily to weekly using a rotary or reel mower; Putting Greens: Daily using a reel mower.

Fertilization Requirements: 2 to 4 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the summer growing season.

Turfgrass Profile: St. Augustinegrass

Latin Name: *Stenotaphrum secundatum* (Walt.) Kuntze

Growth Habit: Stoloniferous
Vernation: Folded
Leaf: Flat, smooth on both surfaces, with a blunt tip
Ligule: Fringe of hairs
Auricles: Absent
Inflorescence: Spicate, with spikelets partially embedded in the rachis

Figure 16. St. Augustinegrass Areas of Adaptation

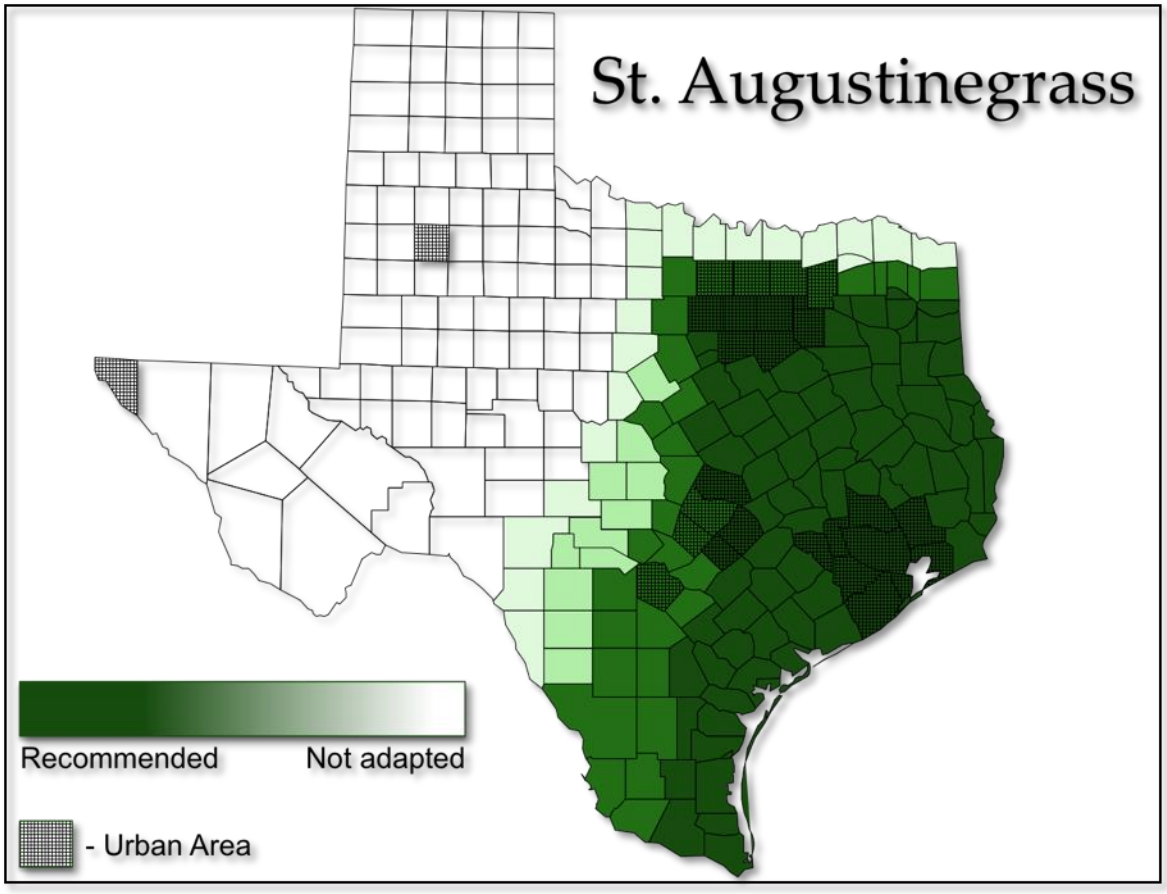


Table 5. Available St. Augustinegrass Varieties in Texas		
Variety	Latin Name	Availability
Amerishade	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Captiva	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Common	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Delmar	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Deltashade	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Floratam	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Mercedes	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Palmetto	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod
Raleigh	*Stenotaphrum secundatum* (Walt.) Kuntze	Sod

Description: St. Augustinegrass is a warm-season turfgrass that is one of the most widely planted species in Texas, particularly in urban environments. This is due to its superior shade tolerance relative to other warm-season grasses as well as its deep rooting potential.

Strengths: Shade tolerance, drought tolerance, deep rooting potential, and rapid establishment.

Weaknesses: Cold tolerance, high disease potential, traffic tolerance, and chinch bugs.

Recommended Mowing Height: 2.5 to 3.5 inches

Recommended Mowing Frequency: Weekly using a rotary mower

Fertilization Requirements: 2 to 4 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the summer growing season.

Turfgrass Profile: Zoysiagrass

Latin Name: *Zoysia* sp.

Growth Habit: Rhizomatous
Vernation: Rolled
Leaf: Hairy on upper surface
Ligule: Fringe of hairs
Auricles: Absent
Inflorescence: Spike with 3-12 spikelets (*Z. pacifica*) or 10-50 spikelets (*Z. japonica* and *Z. matrella)*

Figure 17. Zoysiagrass Areas of Adaptation

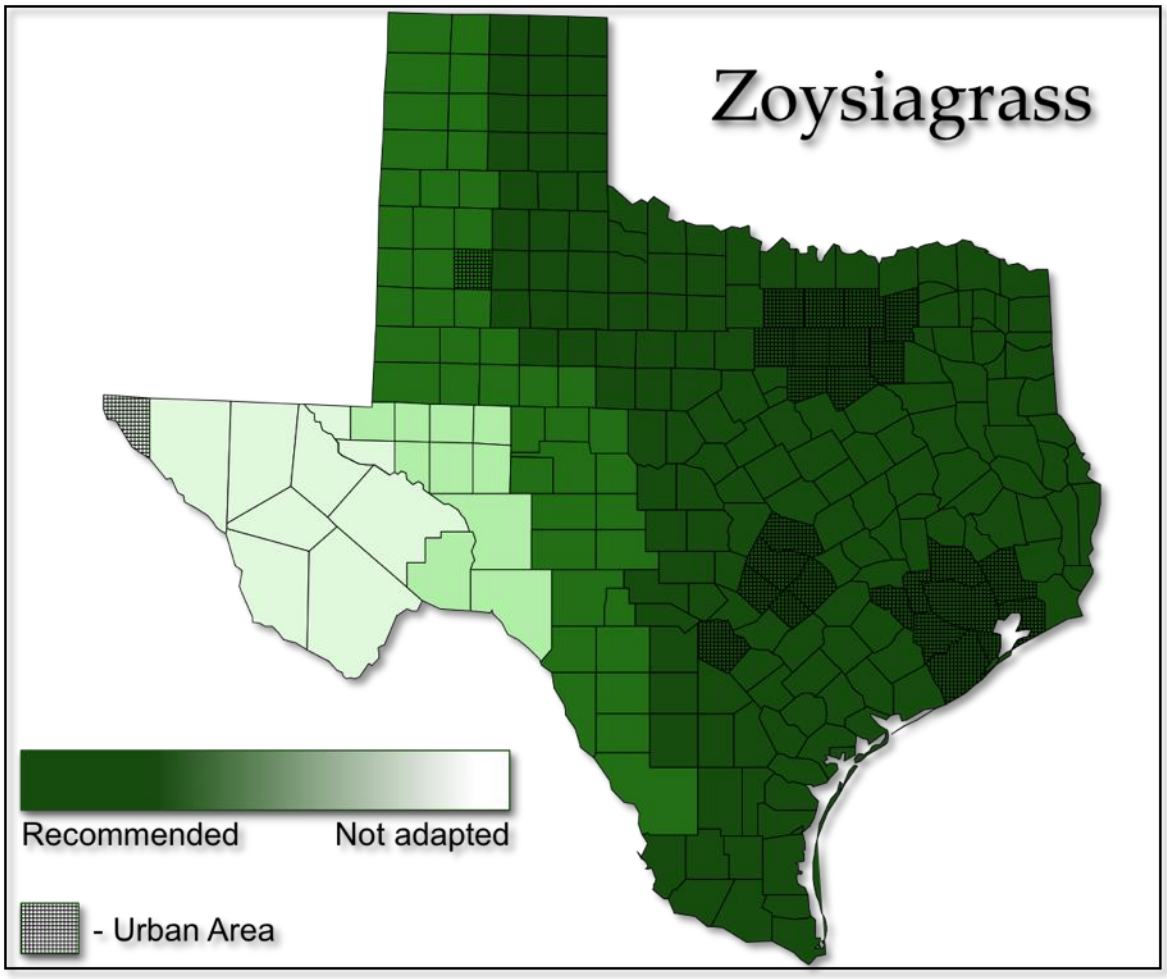


Table 6. Available Zoysiagrass Varieties in Texas		
Variety	Latin Name	Availability
Carrizo	*Zoysia japonica* Steud.	Sod
Cavalier	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Chinese Common	*Zoysia japonica* Steud.	Seed
Compadre	*Zoysia japonica* Steud.	Seed/Sod
Crowne	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Cutlass	*Zoysia japonica* Steud.	Sod
Diamond	*Zoysia matrella* (L.) Merr.	Sod
El Toro	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Emerald	*Zoysia japonica* Steud. x *Zoysia pacifica* (Goudswaard) M. Hota & Kuroki	Sod
Empire	*Zoysia japonica* Steud. x Zoysia *matrella* (L.) Merr.	Sod
Geo	*Zoysia japonica* Steud. x *Zoysia tenuifolia* Willd. Ex Thiele	Sod
Jamur	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Meyer	*Zoysia japonica* Steud.	Sod
Palisades	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Pristine Flora	*Zoysia matrella* (L.) Merr.	Sod
Royal	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Ultimate Flora	*Zoysia matrella* (L.) Merr.	Sod
Y-2	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Zenith	*Zoysia japonica* Steud.	Seed/Sod
Zeon	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod
Zorro	*Zoysia japonica* Steud. x *Zoysia matrella* (L.) Merr.	Sod

Description: Zoysiagrass is warm-season turfgrass that spreads by rhizomes and stolons, and is one of the most diverse turfgrasses available for use. This is primarily due to the fact that there are at least 11 species of zoysiagrass used as a turfgrass, with 2 species (*Z. japonica* and *Z. matrella*) being the most common in the southern United States. Available varieties of *Z. japonica* typically possess coarser leaf texture and better cold tolerance relative to varieties of *Z. matrella*. However, varieties of *Z. matrella* have improved shade tolerance relative to *Z. japonicas*. In addition to *Z. japonica* and *Z. matrella* varieties, there are also many varieties available that are interspecific crosses of *Z. japonica* x *Z. matrella* as well as *Z. pacifica* and Z*. tenuifolia.* In addition to matching each variety of Zoysiagrass to the appropriate environment, consideration should also be given to their management. Coarser-textured varieties (*Z. japonica*) of Zoysiagrass often perform better at higher mowing heights while the finer textured varieties (*Z. matrella*) can tolerate lower mowing heights. However, reel mowers are often necessary to produce adequate turfgrass quality at low mowing heights, which should be considered during turfgrass selection.

Strengths: Shade tolerance, drought tolerance, cold tolerance, traffic tolerance, and low fertilization requirement.

Weaknesses: Thatch, slow recuperative potential, and mower blades need to be routinely sharpened due to stiff leaf blades. Also, many of the finer textured species have shallow roots which result in less drought hardiness, relative to the coarser textured Zoysia species.

Recommended Mowing Height: Home Lawns: 1-2 inches (Rotary mower); Golf and Athletic Turf: 0.5 to 1 inch (Reel mower); Putting Greens: ≤0.150 inches (Reel mower).

Recommended Mowing Frequency: Home Lawns: Weekly using a rotary mower; Golf and Athletic Turf: Daily to weekly using a rotary or reel mower; Putting Greens: Daily using a reel mower.

Fertilization Requirements: 1 to 3 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the summer growing seaso

Turfgrass Profile: Annual ryegrass

Latin Name: *Lolium multiflorum* L.

Growth Habit: Bunch-type
Vernation: Rolled
Leaf: Ridges on upper surface; smooth and glossy on lower surface
Ligule: Membranous, rounded
Auricles: Claw-like
Inflorescence: Spike with many spikelets; 10-20 florets per spikelet

Areas of Adaptation

Annual ryegrass can be used throughout the state of Texas to overseed warm-season turfgrasses for winter color.

Table 7. Available Annual ryegrass Varieties in Texas		
Variety	Latin Name	Availability
Many available	*Lolium multiflorum* L.	Seed

Description: Annual ryegrass is an annual, cool-season turfgrass with a bunch-type growth habit. It is primarily used to overseed warm-season species to provide winter color, but can also be found in home and garden centers as part of cool-season mixtures with other species including perennial ryegrass, tall fescue, and Kentucky bluegrass. These mixtures are most successfully planted in the fall and can provide ground cover throughout the winter months, particularly in shaded areas where warm-season turfgrass will not persist. However, annual ryegrass will not persist as a perennial turfgrass due to its annual life cycle and poor heat/drought tolerance.

Strengths: Shade tolerance, cold tolerance, short germination time, tolerant of low mowing heights, and rapid establishment.

Weaknesses: Annual life cycle, coarse leaf texture, light green color, and poor heat and drought tolerance.

Recommended Mowing Height: Because annual ryegrass is only used as an annual crop to overseed warm-season turfgrasses, the mowing should be determined by the warm-season species being overseeded.

Recommended Mowing Frequency: Every 2-3 days to weekly depending on height of cut using a rotary or reel mower.

Fertilization Requirements: 1 to 2 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the spring and fall growing season.

Turfgrass Profile: Creeping bentgrass

Latin Name: *Agrostis stolonifera* L.

Growth Habit: Stoloniferous
Vernation: Rolled
Leaf: Ridges on upper surface; smooth on lower surface
Ligule: Membranous, finely toothed or entire, rounded
Auricles: Absent
Inflorescence: Panicle

Figure 18. Creeping bentgrass Areas of Adaptation

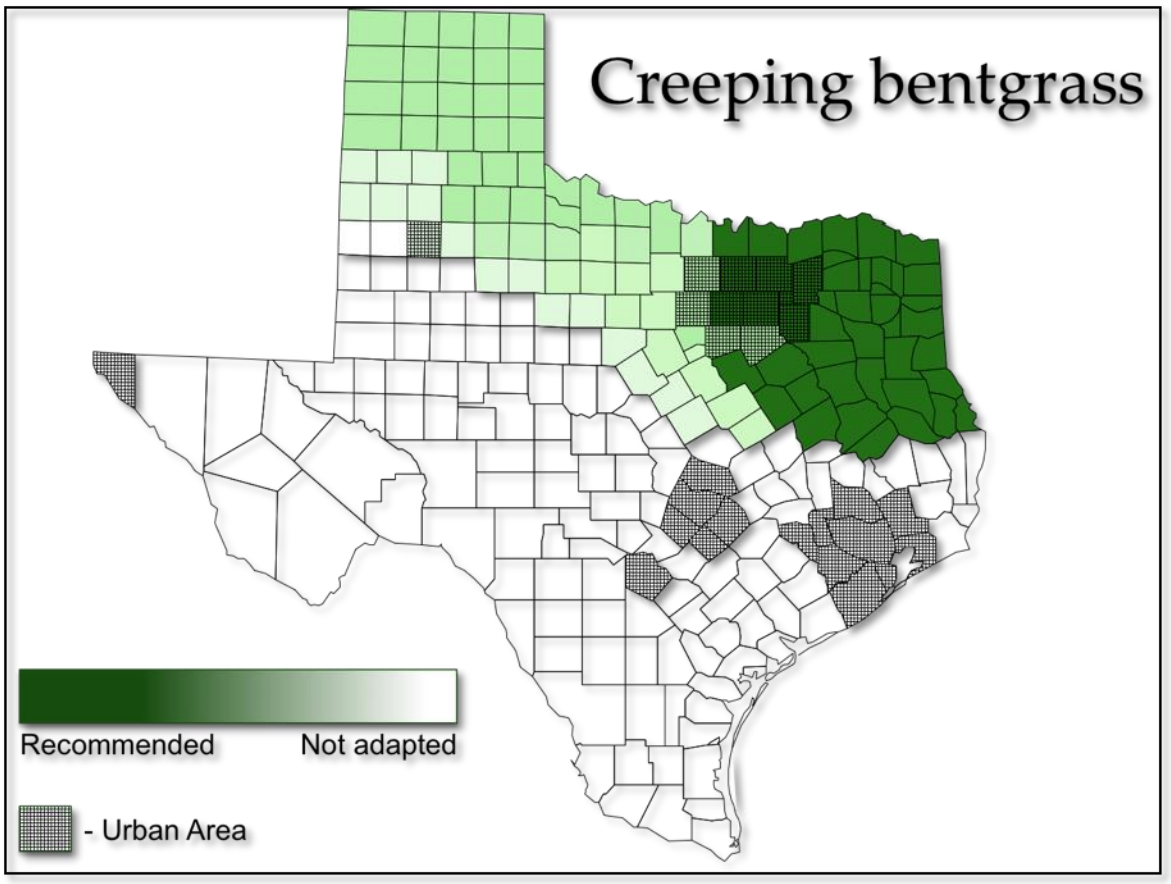


Table 8. Available Creeping bentgrass Varieties in Texas		
Variety	Latin Name	Availability
007	*Agrostis stolonifera* L.	Seed
Alpha	*Agrostis stolonifera* L.	Seed
Crenshaw	*Agrostis stolonifera* L.	Seed
Declaration	*Agrostis stolonifera* L.	Seed
L-93	*Agrostis stolonifera* L.	Seed
Penn A-1	*Agrostis stolonifera* L.	Seed
Penn A-2	*Agrostis stolonifera* L.	Seed
Penncross	*Agrostis stolonifera* L.	Seed
T-1	*Agrostis stolonifera* L.	Seed
Others..	*Agrostis stolonifera* L.	Seed

Description: Creeping bentgrass is a cool-season turfgrass with extremely fine-texture that is capable of tolerating very low mowing heights (≤ 0.125 inches). However, it requires intensive management to be successful and as a result, it is used almost exclusively on golf course putting greens.

Strengths: Shade tolerance, cold tolerance, traffic tolerance, and good recuperative potential due to its stoloniferous growth habit. It can also tolerate extremely low mowing heights.

Weaknesses: Disease incidence, poor heat and drought tolerance, and requires intensive management.

Recommended Mowing Height: Golf course fairways and tee boxes: ≤ 0.5 inches (Reel mower); golf course putting greens: ≤ 0.125 inches (Reel mower).

Recommended Mowing Frequency: Daily using a reel mower

Fertilization Requirements: 3 to 5 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.1 to 0.5 lb of N per 1,000 ft^2 applied during the spring and fall growing season.

Turfgrass Profile: Fine fescue

Latin Name: *Festuca* sp. and ssp.

Growth Habit: Rhizomatous or bunch-type
Vernation: Folded
Leaf: Ridges on upper surface; smooth on lower surface
Ligule: Membranous
Auricles: Absent
Inflorescence: Panicle

Figure 19. Fine fescue Areas of Adaptation

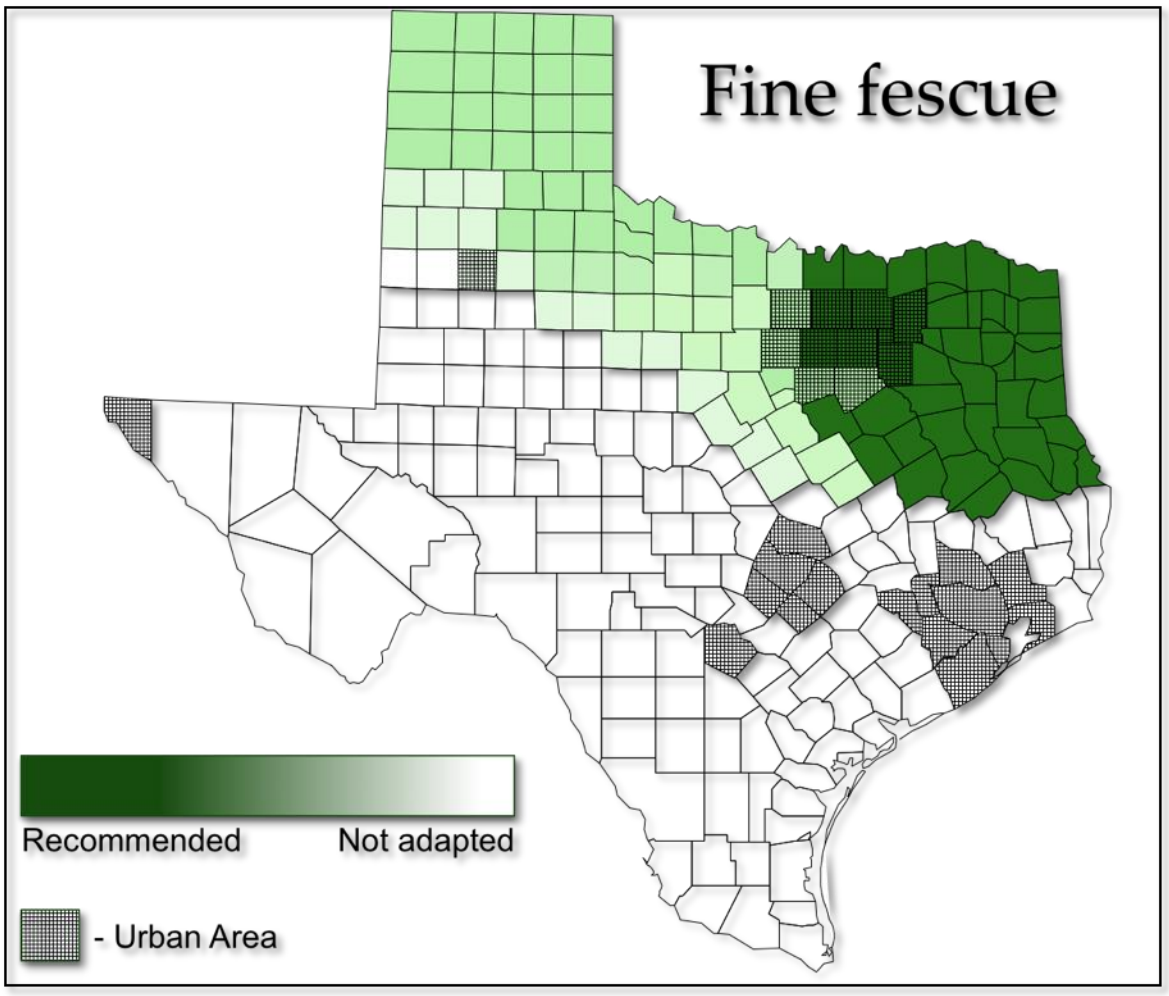


Table 9. Available Fine fescue Varieties in Texas		
Variety	Latin Name	Availability
Many available	*Festuca* sp. and ssp.	Seed

Description: There are 4 species of fine fescues that are primarily used as turfgrass, which include Creeping red fescue (*Festuca rubra* L. ssp.), Chewings fescue (*Festuca rubra* ssp. *commutata* Gaudin), Sheep fescue (*Festuca ovina* L.), and Hard fescue (*Festuca brevipila* Tracey). Creeping red fescue is the only species that spreads by rhizomes, and within this species there are two distinct types that include an aggressive creeping type with strong rhizomes and a slender creeping type with short rhizomes. Chewings fescue, sheep fescue, and Hard fescue are all bunch-type grasses. Due to their superior shade tolerance, fine fescues are commonly found in shade mixtures with other cool-season species including ryegrass, bluegrass, and tall fescue. They perform best when un-mowed and allowed to clump together as they often do in natural areas or un-mowed golf course roughs. Like other cool-seasons species, they have poor heat and drought tolerance and typically do not persist as perennial plants, particular in more southern and western parts of Texas.

Strengths: Shade tolerance, cold tolerance, does well as a component in un-mowed natural areas

Weaknesses: Poor heat tolerance and drought tolerance, does not do well under persistent mowing

Recommended Mowing Height: 2.5 to 3.5 inches or un-mowed

Recommended Mowing Frequency: 2 to 2.5 inches using a rotary mower

Fertilization Requirements: 1 to 2 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the spring and fall growing season.

Turfgrass Profile: Kentucky bluegrass and Hybrid bluegrass

Latin Name: *Poa pratensis* L. and *Poa arachnifera* Torr. x *Poa pratensis* L.

Growth Habit: Rhizomatous
Vernation: Folded
Leaf: Smooth on both surfaces; two light lines adjacent to midvein; boat-shaped tip
Ligule: Short, membranous, truncate
Auricles: Absent
Inflorescence: Panicle

Figure 20. Kentucky and Hybrid bluegrass Areas of Adaptation

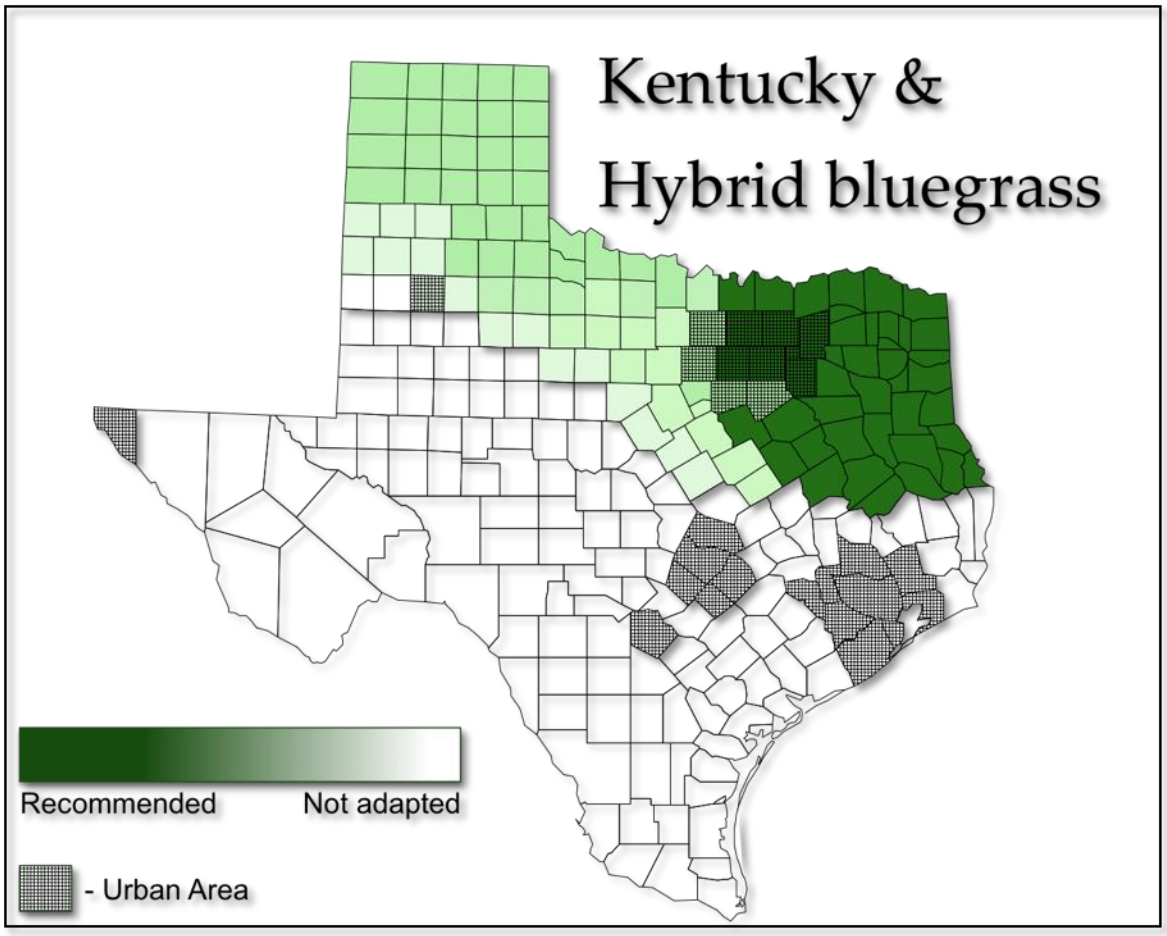


Table 10. Available Kentucky and Hybrid bluegrass Varieties in Texas		
Variety	Latin Name	Availability
Many available	*Poa pratensis* L.	Seed
Bella	*Poa pratensis* L.	Sod
Armadillo	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Bandera	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Dura Blue	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Farhenheit 90	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Fire and Ice	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Longhorn	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Reveille	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed/Sod
Solar Green	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Thermal Blue	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed
Thermal Blue Blaze	*Poa arachnifera* Torr. x *Poa pratensis* L.	Seed

Description: Kentucky bluegrass is a cool-season, fine-textured turfgrass that spreads by rhizomes. It typically has fine leaf texture and dark color which make it an appealing alternative to Tall fescue in the northern parts of Texas where cool-season turfgrasses can sometimes persist as perennials. However, it is not as tolerant to heat and drought as Tall fescue is and is rarely planted as a monostand in Texas. Alternatively, it is often planted in conjunction with Tall fescue or as a component of many cool-season seed mixtures that contain Tall fescue, perennial ryegrass, and annual ryegrass. These mixtures are most successful when planted in shaded areas where warm-season species may struggle, particularly in the northern parts of Texas. However, like all cool-season grasses its lack of heat and drought tolerance do not make it a widely planted turfgrass in Texas.

Strengths: Rhizomatous growth habit, shade tolerance, cold tolerance, and tolerates low mowing heights

Weaknesses: Poor heat and drought tolerance, disease incidence

Recommended Mowing Height: 2 to 2.5 inches

Recommended Mowing Frequency: Every 7 days using a rotary mower

Fertilization Requirements: 2 to 3 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the spring and fall growing season.

Turfgrass Profile: Perennial ryegrass

Latin Name: *Lolium perenne* L.

Growth Habit: Bunch-type
Vernation: Folded
Leaf: Ridges on upper surface and glossy on lower surface
Ligule: Membranous, truncate to rounded
Auricles: small, soft claw-like
Inflorescence: Spike with many spikelets; 2-10 florets per spikelet

Areas of Adaptation

Perennial ryegrass can be used throughout the state of Texas to overseed warm-season turfgrasses for winter color.

Table 11. Available Perennial ryegrass Varieties in Texas		
Variety	Latin Name	Availability
Many available	*Lolium perenne* L.	Seed

Description: Perennial ryegrass is a cool-season turfgrass with dark color, fine leaf texture, and a bunch-type growth habit. It is most widely used as an overseeding crop to provide winter color on bermudagrass golf courses and athletic fields. It is also a component of many cool-season seed mixtures that may contain Tall fescue, Kentucky bluegrass, and/or Annual ryegrass. These mixtures are most successful when planted in shaded areas where warm-season species may struggle, particularly in the northern parts of Texas. However, like all cool-season grasses its lack of heat and drought tolerance do not make it a widely planted turfgrass in Texas.

Strengths: Fine leaf texture, dark color, tolerant of low mowing heights, and rapid establishment.

Weaknesses: Poor heat and drought tolerance

Recommended Mowing Height: Because perennial ryegrass is only used as an annual crop to overseed warm-season turfgrasses, the mowing should be determined by the warm-season species being overseeded

Recommended Mowing Frequency: Every 2-3 days to weekly depending on height of cut using a rotary or reel mower.

Fertilization Requirements: 1 to 2 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the spring and fall growing season.

Turfgrass Profile: Tall fescue

Latin Name: *Schedonorus arundinaceus* (Schreb.) Dumort

Growth Habit: Bunch-type
Vernation: Rolled
Leaf: Broad, flat; Ridges on upper surface and smooth on lower surface; Prominent midrib on lower surface

Ligule: Membranous, truncate
Auricles: Short, blunt, pubescent
Inflorescence: Panicle

Figure 21. Tall fescue Areas of Adaptation

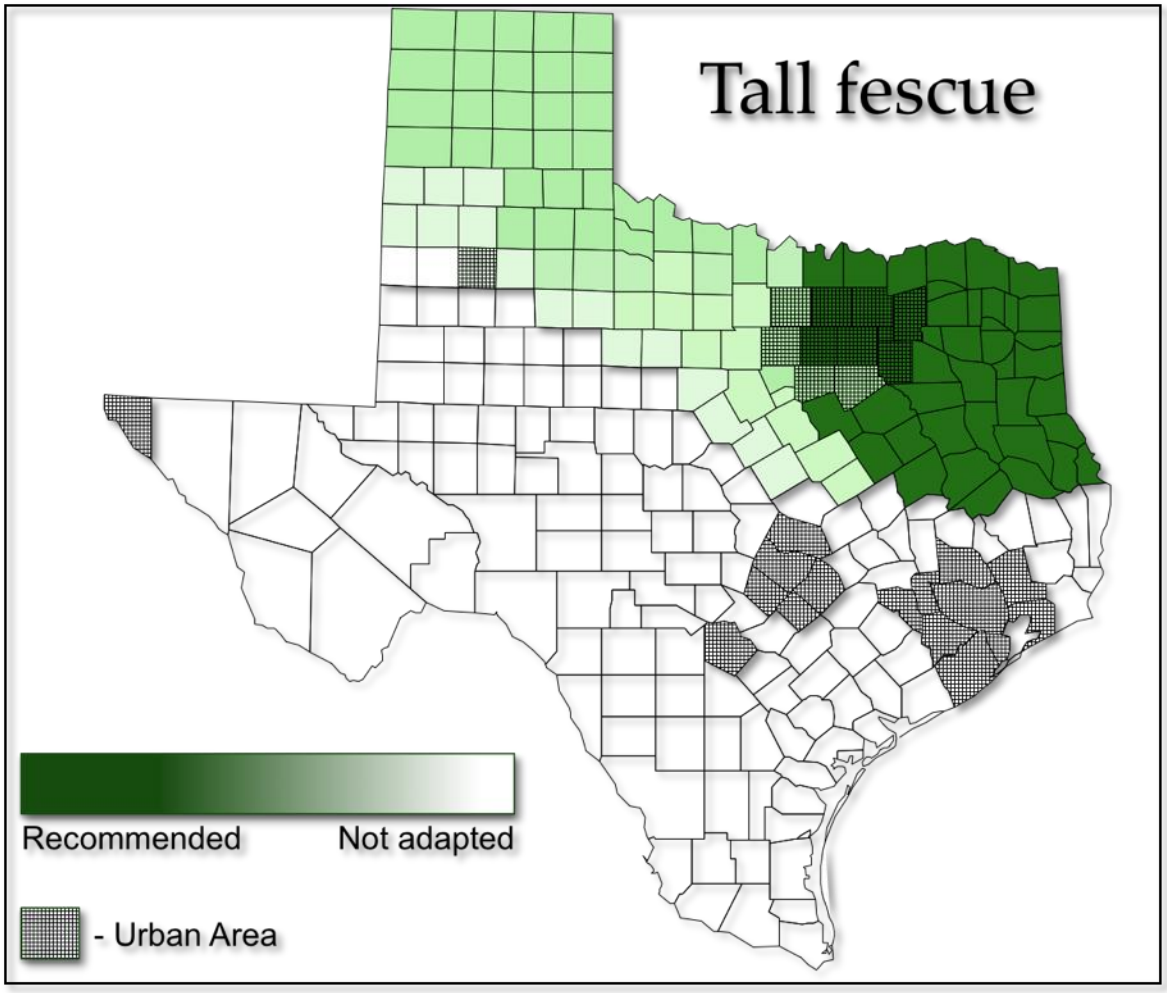


Table 12. Available Tall fescue Varieties in Texas		
Variety	Latin Name	Availability
Many available	*Schedonorus arundinaceus* (Schreb.) Dumort	Seed/Sod

Description: Tall fescue is a coarse-textured, cool-season turfgrass with dark green color and a bunch-type growth habit. Relative to other cool-season grasses, its superior heat and drought tolerance make it adapted for use in north Texas where warm-season grasses may struggle with winter injury. Like other cool-season species, it also performs well in shade and is used as a component of cool-season seed mixtures with Kentucky bluegrass, perennial ryegrass, and annual ryegrass. However, like all cool-season grasses its lack of heat and drought tolerance do not make it a widely planted turfgrass in Texas.

Strengths: Shade tolerance, cold tolerance, dark color, and rapid establishment

Weaknesses: Poor heat and drought tolerance, disease incidence

Recommended Mowing Height: 2.5 to 4 inches

Recommended Mowing Frequency: Weekly using a rotary mower

Fertilization Requirements: 2 to 4 lbs N per 1,000 ft^2 per year. Single application rates should range from 0.5 to 1 lb of N per 1,000 ft^2 applied during the spring and fall growing season.

Weed Control in Texas Turfgrasses

Herbicides are an effective tool that can be used to manage weeds in turfgrasses and are most successful when used as part of an overall turfgrass integrated pest management (IPM) plan. Management practices that promote healthy turf include proper species/variety selection, adequate fertilization based on soil testing, frequent mowing at the proper height, proper irrigation, etc. This results in turfgrasses that are often able to out-compete many weeds for resources needed for growth, particularly light. In cases where weeds are still present, herbicides provide turfgrass managers with the ability to selectively remove specific weed species without any injury to the turf. However, when selecting herbicides for use, there are several things that should be considered prior to application including turfgrass tolerance, herbicide selectivity, application rate/timing, herbicide mode of action, etc.

Weed Identification

Weeds, like all plants, are classified based on morphological characteristics of their vegetative and reproductive structures. A basic understanding of the types of weeds commonly found in turf is very helpful in identification and herbicide selection. One way that weeds are often grouped by morphological characteristics is into the categories: *broadleaf weeds, grassy weeds,* and *sedges* (Table 13).

Table 13. General Characteristics of Weed Species when grouped as Broadleaf weeds, Grassy Weeds, or Sedges.

	Broadleaf Weeds	Grassy Weeds	Sedges
Embryo	Dicot	Monocot	Monocot
Stem	Usually solid, variable in shape	Hollow, round of flattened	Solid, usually triangular
Leaf Shape	Variable	Simple, entire	Simple, entire
Leaf Arrangement	Variable	Alternate, 2-ranked	Alternate, 3-ranked
Leaf Veins	Netted	Parallel	Parallel
Inflorescence	Highly variable, often colored and showy	Spike, Raceme, or Panicle.	Head-like with flattened spikelets
Secondary Growth	None, Tubers, Bulbs, Rhizomes, Stolons, etc.	None, Rhizomes, and/or Stolons	None, Rhizomes, and/or Tubers
Family Classification	Many	*Poaceae*	*Cyperaceae*
Examples	Henbit, Chickweed, Spurges, Slender Aster, etc.	Crabgrass, Dallisgrass, Annual bluegrass, Smutgrass, etc.	Purple and Yellow nutsedge, Green kyllinga, etc.

This is helpful because herbicides are often particularly effective on one or more of these groups. For example, synthetic auxin herbicides (i.e. 2,4-D, MCPA, dicamba, triclopyr) are usually combined to form products that provide inexpensive broadleaf weed control. However, these products will not control

grasses or sedges. Similarly, there are many available herbicides that are effective at controlling grassy weeds, but not broadleaf weeds or sedges, and vice versa. As a results, weed identification and herbicide selection are extremely important in properly managing weeds in turfgrass settings.

The weeds in Table 14 were identified by university and industry personnel at the Southern IPM meeting held in College Station, Texas on October 23rd, 2014 as the most problematic turfgrass weeds found in Texas turfgrasses.

Table 14. Problematic Weeds in Texas Turfgrass Production and Management[1]	
Weed	Latin Name
Annual blue-eyed grass	Puncture-vine
Annual bluegrass	Purple deadnettle
Bahiagrass	Purple nutsedge
Bentgrass in bermudagrass	Rescuegrass
Bermudagrass in other turfgrasses	Sandbur
Dallisgrass	Silverleaf nightshade
Dichondra	Slender aster
Doveweed	Smutgrass
Goosegrass	Spotted spurge
India crabgrass	Sprangletop
Junglerice	Torpedograss
Khakiweed	Tropical signalgrass
King Ranch bluestem	Virginia buttonweed
Lawn burweed	Zoysiagrass in other grasses
Lespedeza	
[1]These weeds were identified by the Southern IPM Pest Management Working Group in a meeting held in College Station, TX on October 23rd, 2014. [2]These weeds were all classified as problematic but are in no particular order of frequency or difficulty.	

Herbicide Application Timing

The second component of selecting the proper herbicide selection is deciding when the product should be applied, relative to which growth stage the herbicide is targeting. Classification of weeds by life cycle includes winter annuals, summer annuals, perennials, and less frequently, biennials. Each of these weeds can be present during the same months, but at very different growth stages depending on their life cycle. This distinction is important because it affects which types of herbicides will be effective.

Pre-Emergence Herbicides

Sometimes referred to as “pre” herbicides, they must be applied before emergence or germination of the target weed or they will not provide control. These herbicides are commonly used to control **annual** weeds.

These herbicides are applied so that the active ingredient (herbicide molecule) reaches the soil. Thus, the active ingredient is often formulated on a granular carrier and applied through a rotary or drop spreader. Other times, these products are designed to be mixed with water and applied through a sprayer. Regardless of application method, pre-emergence herbicides must be watered into the soil by rainfall or irrigation before the target weed emerges, or they will not be effective. Consult the herbicide label for specific information on the amount of irrigation/rainwater that must be applied. Application rates may very based on soil texture and organic matter content; know these characteristics to maximize herbicide efficacy and prevent injury to desirable turfgrasses. Consult the herbicide label for more information.

After they are watered into the soil, the herbicide molecules remain in the upper layer of soil and will control seeds that germinate. It is important to remember that these herbicides will control both weedy and desirable grasses that germinate from seed. Additionally, many pre-emergence herbicides cannot be applied prior to sprigging or sodding. In general, these herbicides should be applied only to well-established turfgrass.

As these herbicide molecules remain in the soil, soil microbes slowly break them down. After enough microbial degradation occurs (usually after several weeks), the herbicide will no longer be effective. Multiple applications may be required to provide season-long control of summer and annual weeds. In these cases, the single application rate can be reduced; consult the product label for specific information about application rates and timings.

Table 15. Pre-emergence Herbicides Registered for use in Texas Turfgrasses.					
Common Name (AI/A)	Trade Name (product/A)	Turfgrass	Weed Controlled	Comments	HRAC Group
atrazine (1-4 lbs)	Aatrex 4L 1-4 qt/A others	CE, SA, Z	annual grassy weeds, many broadleaf weeds	Provides annual bluegrass control shortly after emergence. Do not use on alkaline or muck soils. Do not apply 4 months before or 6 months after seeding; or until newly seeded grasses have overwintered.	C1, 5
benefin (1.5– 3.0 lbs)	Balan 2.5 g (60 – 120 lbs) others	BA, BE, CE, KB, PR, SA, TF, Z	annual grassy weeds, some small-seeded broadleaves		K1, 3
benefin + triflualin (1.5 – 3 lbs)	Team 2G (75-150 lbs) Team Pro (see label) Many fertilizer carriers	Most cool- and warm-season turfgrasses – see label	annual grassy weeds, some small-seeded broadleaves	In bermudagrass areas overseeded with winter grasses, this product may thin overseeded grasses. Do not apply to newly sprigged areas.	K1, 3
bensulide (7.5 - 12.5 lbs)	Bensumec 4LF (1.88-3.13 gals) Pre-San 7G (107-180 lbs) Pre-San 12.5G (80-100 lbs)	BA, BE, CBG, CE, FF, KB, PR, SA, TF, Z	annual grassy weeds, some small-seeded broadleaves	Can be used on creeping bentgrass putting greens.	N, 8
DCPA (10.5-15 lbs)	Dacthal (14-20 pts)	Most established and newly	some annual grassy and small-seeded	Can be applied to newly-seeded grasses that are at least 1-2 inches tall and	Z, 17

		seeded grasses. See label	broadleaf weeds,	exhibits uniform green color. Should be activated by 0.25 inches of rain or irrigation within 5 days of application. If soil moisture is below 10%, irrigate immediately.	
dithiopyr (0.25 – 0.5 lbs)	Dimension 2EW (1-2 pts) Dithiopyr 2L (1-2 pts) Dimension Ultra 40WP (0.625-1.25 lbs) Dithiopyr 40WSB (0.625-1.25 lbs) Several others and many fertilizer carriers	BA, BE, BU, CA, CBG, CE, FF, KB, PR, SA, TF, Z	annual grassy weeds, some small-seeded broadleaves	Can provide early post-emergent crabgrass control. Do not apply to Tifgreen (328) hybrid bermudagrass.	K1, 3
dimethenamid (1 – 1.5 lbs)	Tower 6 EC (21 – 32 fl oz/A)	BA, BE, BU, CE, FF, KB, PR, SA, SS, TF, Z	annual grassy weeds, several small-seeded broadleaves, sedges can aid in removal of overseeded cool-season grasses in warm-season turf	Should be activated by 0.25-0.5 inches of rain or irrigation within 24 hours of application. For control of grassy and broadleaf weeds, it is best used in a sequential application program after a pendimethalin application. Application to cool-season turfgrass may cause unacceptable injury.	K3, 15
ethofumesate	Prograss 1.5 EC	BE, CBG, KB,	annual	For use by professional	N, 8

(0.75 – 2.0 lbs)	(0.5 – 1.33 gals) Prograss 4 SC (0.75 – 2 qts /A)	PR, TF, SA	bluegrass, crabgrass, foxtail, some broadleaf weeds, sedges	applicators only. Apply to only to dormant bermudagrass. Consult label for specific instructions on application to all other turf species. Can be used for post-emergence annual bluegrass control and bermudagrass suppression	
flumioxaxin (4 – 8 oz)	SureGuard 51 WDG (8-12 oz)	BE	several broadleaf and grassy weeds; provides post-emergence control of many weeds.	See supplemental label for use in turfgrass. Apply to dormant bermudagrass only. When applying upslope of sensitive cool-season grasses follow label to prevent off-target movement.	E, 14
indaziflam (0.5-0.8 oz)	Specticle Flo (6 – 10 fl oz) Specticle 20 WSP (2.5 – 5 oz wt/A)	BA, BE, BU, CE, SA, Z	annual grassy weeds, some small-seeded broadleaves, sedges emerging from seed	Provides early post-emergent control of annual bluegrass and crabgrass. Should be activated by 0.25 inches of rain or irrigation within 2 days of application Do not apply to bermudagrass overseeded with ryegrass. When applying upslope of sensitive cool-season grasses follow label to prevent off-target movement.	L, 21
isoxaben	Gallery 75 DF	BA, BE, BU,	broadleaf	Tank mixtures with pre-	L, 21

(0.5 – 1 lb)	(0.66 – 1.33 lbs) Isoxaben 75 WG (0.66 – 1.33 lbs)	CBG, CE, FF, KB, PR, SA, TF, Z	weeds	emergence herbicides that control grasses will broaden the spectrum of weed control. Can be applied after sprigging many warm-season turfgrasses.	
metolachlor	Pennant Magnum 7.62 EC (1.3-2.6 pts)	BA, BE, CE, SA, Z	annual grassy weeds, some small-seeded broadleaves, sedges	Activate with at least 0.5 inches of rainfall irrigation before weeds germinate and within 14 days of application. Delayed spring greenup may occur following application.	K3, 15
oryzalin (1.5 – 2 lbs)	Surflan AS (1.5 – 2 qt/A) Several other formulations	BA, BE, BU, CE, SA, TF, Z	annual grassy weeds, some small-seeded broadleaves, sedges	Do not apply in the spring to tall fescue planted the previous fall. This herbicide will thin overseeded grasses.	K1, 3
oxadiazon (see label)	Ronstar Flo 3.17L (5-7.5 pts) Ronstar 50 WSP (4-8 lbs) Ronstar G (see label)	BE, BU, CBG, KB, PR, SA, SS, Z	annual grassy weeds, some small-seeded broadleaves, sedges	Not for use on home lawns. For use only by professional applicators. Sprayable formulations may only be applied to dormant warm-season turf. Granular formulation may be applied to non-dormant warm-and cool-season turf. Apply so that granules reach the soil surface. Do not apply to wet turf. Can be applied before or after sprigging.	E, 14
oxadiazon +	Anderson's	BE, CBG, KB,	crabgrass,	For use by professional	E, 14 + N,

bensulide (see label)	crabgrass/goosegrass control (see label)	PR, TF, Z	goosgrass	applicators only. Can be applied to bentgrass and bermudagrass putting greens under conditions of very heavy goosegrass infestation where injury is tolerable	8
prodiamine (0.32 – 1.5 lbs)	Barricade 65 WG (0.5 - 2.3 lbs) Barricade 4 FL (10 - 48 fl oz) ProClipse 65 WDG (0.5 - 2.3 lbs) Several others and many fertilizer carriers	BA, BE, CBG, CE, FF, KB, PR, SA, TF, Z	annual grassy weeds, some small-seeded broadleaves	Should be activated by at least 0.5 inches of irrigation before weeds germinate and within 14 days of application.	K1, 3
prodiamine (0.33 – 0.75 lbs) + quinclorac (0.33 – 0.75 lbs)	Cavalcade PQ (1-2.3 lbs)	BE, BU, CBG, FF, KB, PR, SS, Z	annual grassy weeds, some small-seeded broadleaves; post-emergence control of many broadleaf and some grassy weeds including crabgrass	Apply with methylated seed oil. If rainfall does not occur within 7 days after application irrigate to 0.5 inches.	K1, 3 + L, 21 (monocot) O, 4 (dicot)
prodiamine (0.17-0.75 lb) + sulfentrazone (0.08 – 0.37 lb)	Echelon 4 SC (8-36 fl oz)	BA, BE, BU, CA, CBG, CE, FF, KB, PR, SA, SS, TF, Z	annual grassy weeds, some broadleaf weeds, sedges	Will provide early post-emergence control of some broadleaf weeds and yellow nutsedge. May cause temporary injury or	K1, 3 + E, 14

				discoloration to St. Augustinegrass. Do not apply in combination with the plant growth regulator trinexapac-ethyl.	
pronamide (0.5 – 1.0 lbs)	Kerb 3.3 SC (1.25 - 2.5 pts. Kerb 50 WP (1 - 2 lbs)	BE, CE, SA, Z	annual grassy weeds	Restricted use pesticide. Not for use on residential sites. Provides early post emergence control of several grassy weeds. Should be activated by light rainfall or irrigation within 24 hours of application. When applying upslope of sensitive cool-season grasses follow label to prevent off-target movement. Will remove overseeded perennial ryegrass from bermudagrass slowly (4-6 weeks); apply after 50% bermudagrass greenup to prevent bermudagrass injury.	K1, 3
siduron (2-12 lbs)	Tupersan 50 WP (4-24 lbs)	CBG, FF, PR, TF, Z	crabgrass, foxtail, bermudagrass supression	Can be applied on CBG putting greens to suppress bermudagrass encroachment. Can be used during the establishment of zoysiagrass from sprigs	C2, 7
simazine (1-4 qt)	Princep (1-4 lbs)	BE, CE, SA, Z	Winter annual grassy and broadleaf weeds. Some summer annual	Do not exceed 1 qt/A per treatment on hybrid bermudagrass or newly-sprigged bermudagrass. Provides both pre and	C1, 5

			grasses.	early post emergence control of many weeds. See label for use on muck or alkaline soils. Temporary yellowing or slowing of growth may occur on non-dormant bermuda or zoysiagrass.	

Turfgrass Codes
B - bluegrass - type not specified
BA - bahiagrass
BE – bermudagrass
BU- buffalograss
CBG – creeping bentgrass
CA - carpetgrass
CE - centipedegrass
F - Fescue - type not specified
FF – fine fescue
KB – Kentucky bluegrass
PR – perennial ryegrass
R- ryegrass - type not specified
SS – Seashore paspalum
SA – St. Augustinegrass
TF – tall fescue
Z – Zoysiagrass

Selective Post-Emergence Herbicides

These herbicides are effective when they are applied after the target weed has emerged and is visible. These herbicides can be used to control both annual and perennial weeds. Many post-emergent herbicides have soil activity, so it is important to check the herbicide label prior to re-seeding, sprigging or sodding after application.

Most post-emergent herbicides are effective when they contact the leaf and are subsequently absorbed into the plant. Thus, products with post-emergent herbicides are most often mixed with water and applied through a sprayer. Adjuvants such as non-ionic surfactants, crop oils, or methylated seed oil are often recommended to increase herbicide absorption through the leaf cuticle. Product labels often provide information on the appropriate use of adjuvants.

Selectivity of the herbicide for the weed and not the desirable turfgrass is often dependent on the ability of healthy turfgrass to metabolize or break down the herbicide to a non-phytotoxic form more effectively than the target weed. Thus, it is important to apply these products to healthy, actively growing turfgrass at the rate indicated on the product label..

Precautions

Legal Restrictions

In certain counties application of both ester and amine phenoxy herbicides (i.e. 2,4-D, MCPA, etc.) are restricted or regulated under chapter 76 of the Texas Agricultural code. These restrictions often vary based on the time of year. Ensure you are aware of these regulations before applying these herbicides.

In the guide below, ester herbicides will be specified but amine and acid formulations will not be specified. For example, an amine or acid formulation will be listed as “2,4-D”, while an ester formulation will be listed as “2,4-D ester”. Ester formulations are more volatile than amine formulations.

Environmental Conditions

Environmental conditions such as temperature, rainfall, and plant nutrient status play a major role weed control efficacy and turfgrass injury. Always read the label to ensure environmental conditions are proper. Generally, warm-season turfgrasses are most susceptible to injury in early spring and late fall when temperatures are cool and they are emerging from or entering dormancy. Cool-season turfgrasses are more susceptible to injury during summer months. Environmental conditions that enable active growth of target weeds will usually result in the best weed control.

Table 16. Selective Post-emergence Herbicides Registered for use in Texas Turfgrasses					
Common Name (AI or AE/A)	Trade Name (product/A)	Turfgrass	Weeds Controlled	Comments	HRAC, WSSA Group
2,4-D (0.44-0.75 lb)	Hardball 1.74L (1-1.75 qt) others	B, BE, PR, TF, Z	Broadleaf weeds	Some broadleaf weeds are not controlled by 2,4-D alone. For more broad-spectrum control, combine with other active ingredients. Rates and recommended turf species different for sod farms.	O, 4
2,4-D (1-1.5 lbs)	Weedar 64 3.8L (1 - 1.5 qt) others	see label	Broadleaf weeds	Amine formulations are less volatile than ester or acid formulations.	O, 4
2,4-D (0.56-1.13) + clopyralid (0.03 - 0.07) + dicamba (0.07 - 0.14)	Millennium Ultra 2 3.56L (1.5 - 3 pt)	B, BA, BE, CBG, F, R, Z	Many broadleaf weeds	Provides broad-spectrum broadleaf weed control. Use on hybrid bermudagrass not specified. Do NOT apply to residential turfgrass or where clippings are collected.	O, 4
2,4-D (0.4 - 1.2 lb) + dicamba (0.43 - 0.125 lb) + quinclorac (0.04 - 0.12 lbs)	2DQ 3.86L (1 - 3 pt)	BA, BE, CBG, CE, KB, RA, PR, SA, TF, Z	Many broadleaf weeds	Provides broad-spectrum broadleaf weed control. Apply to centipede and St. Augustine grasses during dormancy only. Can be applied to bentgrass putting and bowling greens at reduced rates.	O, 4
2,4-D ester (0.5 - 1.1 lbs) + mecoprop (0.13-0.29 lbs) + dicamba (0.05 - 0.11 lbs) + (0.5 -	4-Speed (1.8 - 4.0 pts)	B, BA, BE, CBG, F, R, Z	Many broadleaf weeds	Can be applied to bentgrass putting greens.	O, 4 + E, 14

1.1 g) pyraflufen-ethyl					
2,4-D ester (0.5 - 1.1 lbs) + triclopyr ester (0.06 - 1.1 lbs) + dicamba (0.06 - 1.1 lbs) + (0.6 -1.2 g) pyraflufen-ethyl	4 Speed XT (1.8 - 4 pts)	BA, BE, CBG, F, B, PR, Z	Many broadleaf weeds	Can be applied to bentgrass putting greens.	O, 4 + E, 14
2,4-D (0.8 -1.2 lbs) + fluroxypyr ester (0.1 - 0.15 lbs) + dicamba (0.1 - 0.15 lbs)	Escalade 2 (2-3 pts)	B, BA, BE, CA, CBG, F, R, Z	Many broadleaf weeds	Application rate lower for sod farms. Do make broadcast applications to carpetgrass when temperatures exceed 80 F. Applications to dormant bermuda, bahia and zoysia grasses are suggested.	O, 4
2,4-D (0.5 - 1.1 lbs) + MCPA (0.14 - 0.3 lbs) + dicamba (0.05 - 0.1 lbs)	EndRun (1.8 - 4 pts)	BA, BE, BU, CBG, FF, KB, RA, PR, TF, Z	Many broadleaf weeds	Do not apply to warm-season turfgrass unless temporary injury can be tolerated.	O, 4
2,4-D (0.6 - 1.1 lbs) + clopyralid (0.03 - 0.07 lbs)+ dicamba (0.07 0.14)	Millennium Ultra 2 (1.5 - 3 pts)	B, BA, BE, CBG, F, R, Z	Many broadleaf weeds	Not for use on residential turfgrass. Do not collect clippings for compost after application.	O, 4
2,4-D (0.3 - 0.6 lbs) + mecoprop (0.15 - 0.3 lbs) + dichlorprop (0.15 - 0.3 lbs)	Triamine (1.75 - 4 pts)	B, BA, BE, CBG, CE, F, R, SA, Z	Many broadleaf weeds	Not for turf being grown for sod. Do not make broadcast applications to carpetgrass or St. Augustinegrass when temperature exceeds 80 F.	O, 4
2,4-D (0.57 - 1.35 lbs) + mecoprop (0.15 - 0.36 lbs) + dichlorpop (0.15-0.36 lbs)	Spoiler (1.7 - 4 pts)	B, BA, BE, CBG, F, R, Z	Many broadleaf weeds	Can be applied to bentgrass golf and bowling greens as well as golf tees. However, temporary injury may occur.	O, 4

2,4-D (0.54 - 1.2 lbs) + mecoprop (0.14 - 0.32 lbs) + dicamba (0.05 - 0.11 lbs)	Triplet SF (1.8 - 4 pts)	B, BA, BE, CBG, CE, F, R, SA, Z	Many broadleaf weeds	Apply only to dormant centipede grass and certain St. Augustinegrass varieties in Texas, Louisiana and Mississippi only. Can be applied to golf course tees, but injury may occur.	O, 4
2,4-D (0.54 - 1.2 lbs) + mecoprop (0.14 - 0.32 lbs) + dicamba (0.05 - 0.11 lbs)	Triplet Low Odor (1.8 - 4 pts)	B, BA, BE, CBG, CE, F, R, SA, Z	Many broadleaf weeds	Can be applied to golf course tees but temporary injury may occur. Avoid over application to bent, St. Augustine and Centipede grasses. Professional applicators only.	O, 4
2,4-D (0.5 - 1 lbs) + mecoprop (0.13 - 0.27 lbs) + dicamba (0.05 - 0.11 lbs)	Trimec Classic (2-4 pts)	BA, BE, CE, SA, Z. Cool-season grasses,	Many broadleaf weeds	Can be applied to bentgrass putting and bowling greens. Spot applications in Centipede and St. Augustine grasses are suggested as injury is likely. Do not apply when temperatures exceed 85 F.	O, 4
2,4-D (0.18 - 0.54 lbs) + Mecoprop (0.17 - 0.5 lbs) + + dicamba (0.04 - 0.11 lbs)	Trimec Southern (1-3 pts)	B, BE, CBG, CE, F, SA, Z	Many broadleaf weeds	Do not make applications to St. Augustine or Centipedegrass when air temperatures of < 50 F or > 90 F are expected within 72 hours of application.	O, 4
amicarbazone (0.7 - 7 oz)	Xonerate (1 - 10 oz/A)	BA, BE, BU, CBG, CE, FF, KB, PR, SA, SS, TF, Z	Many broadleaf, some grassy weeds including annual bluegrass	Temporary yellowing of turf may occur after application. Apply to cool-season turfgrass in the spring only as applications in the summer or fall will result in severe injury. Do not apply if soil pH is greater than 7.4. Turfgrass species tolerance varies widely; read label carefully.	C1, 5
asulam (2 lbs)	Asulox (5 pts)	BE (Tifway only), SA	Grassy weeds including goosegrass, crabgrass, and sandbur	For use on sod farms only. For use only on Tifway (419) bermudagrass.	I, 18

bentazon (0.75 - 1 lb)	Basagran T&O (24 - 32 fl oz/A)	B, BE, BA, BU, CA, CBG, CE, F, R, SA, Z	Some broadleaf weeds, yellow nutsedge, annual sedge.	Apply to newly emerged or small weeds before they reach their maximum size. Thorough spray coverage is important to maximize weed control. Sequential applications are likely required for adequate yellow nutsedge and thistle control.	C, 5
bispyribac-sodium (0.4 - 1.1 oz)	Velocity (2 - 6 oz)	CBG, PR	Some broadleaf weeds, annual and roughstalk bluegrass	Can be used in bermudagrass overseeded with perennial ryegrass. Do not apply to golf greens or roughs. Do not apply to wet turfgrass. If applied in the fall under cool temperatures, turfgrass injury will last longer. Do not apply to cool-season turfgrass in the summer.	B, 2
bromoxynil (0.25 - 0.5 lbs)	Buctril (1 - 2 pts)	BA, BE, CBG, F, KB, PR, R, SA, Z	Broadleaf weeds.	Do not apply to residential, playground or schoolyard turfgrass. For control of immature weeds. To broaden weed control spectrum, see label for suitable tank-mix partners.	C3, 6
carfentrazone (0.24 - 1.6 oz)	Quicksilver (1 - 6.7 fl oz)	Most cool- and warm-season grasses. See label	Some broadleaf weeds. Moss	Can be applied to creeping bentgrass and hybrid bermudagrass putting greens for moss control. See label for guidelines on adjuvant use. Can be applied to many seedling turfgrass as soon as 7 days after emergence from seed or sprigs. Apply at up to 2.1 fl oz/A for broadleaf weed control and up to 6.7 fl oz/A for moss control.	E, 14
Carfentrazone (0.013 - 0.030 lbs) + 2,4-D ester	SpeedZone (2 - 5 pts)	B, BE, BU, CBG, FF, PR, R, TF,	Many broadleaf weeds	Application to fully dormant bermuda buffalo and zoysia grasses are suggested. Buffer	E, 14 + O, 4

(0.4 - 1.0 lbs) + mecoprop (0.12 - 0.3 lbs) + dicamba (0.04 - 0.09 lbs)		Z		spray solution to between pH 5 and 8. Using nozzles that produce large (> 400 micron) spray droplets may reduce weed control.	
Carfentrazone (0.008 - 0.025 lbs) + 2,4-D ester (0.1 - 0.3 lbs) + mecoprop (0.04 - 0.13 lbs) + dicamba (0.01 - 0.03 lbs)	SpeedZone Southern (1.5 - 5 pts)	B, BE, BA, BU, CBG, CE, FF, PR, R, SA SS, TF, Z	Many broadleaf weeds	Buffer spray solution to between pH 5 and 8. Do not apply to 'Floratam' or 'Bitterblue' St. Augustinegrass. See label for more information on St. Augustinegrass application. Applications to dormant warm-season turfgrass are suggested.	E, 14 + O, 4
Carfentrazone (0.01 - 0.03 lbs) + MCPA ester (0.54 - 1.4 lbs) + mecprop (0.11 - 0.28 lbs) + dicamba (0.06 - 0.14 lbs)	Powerzone (2-5 pts)	BE, FF, KB, PR, TF, Z	Many broadleaf weeds	Applications to dormant bermudagrass and zoysiagrass are suggested.	E, 14 + O, 4
Carfentrazone (0.3 - 0.7 oz) + quinclorac (0.3 - 0.75 lbs)	SquareOne (8-18 oz)	BE, BU, CE, FF, KB, PR, SS, TF, Z	Broadleaf and grassy weeds	Tall fescue and warm-season turfgrasses may exhibit temporary yellowing if applications are made during the transition period or when the turfgrass is under stress. Do not use clippings as mulch or compost.	E, 14 + L, 21(monocot) O, 4 (dicot)
Clopyralid (0.1 - 0.5 lbs)	Lontrel, Clean Slate (0.25 - 1.33 pts)	BA, BE, BU, CBG, CE, FF, KB, PR, SA, SS, TF, Z	Broadleaf weeds	Can be applied to dichondra, conifers and ornamental grasses. Provides excellent control of various clover and thistle species. Not for use in residential turfgrass.	O, 4

dicamba (see label)	Banvel, Vanquish, Vision, others (See label)	See label	Many broadleaf weeds	Use site and rate varies by trade name. Do not use in areas where downward movement into the soil or surface washing will contact the roots of desirable trees and shrubs; use extra precaution on sandy soils.	O, 4
diclofop	Illoxan	BE	goosegrass	Manufacturing discontinued in 2014. For use on golf courses only. Can be applied to ultradwarf putting greens.	A, 1
fenoxaprop (0.25 - 2.8 oz)	Acclaim Extra (3.5 - 39 fl oz)	CBG, FF, KB, PR, TF, Z	grassy weeds including goosegrass and crabgrass	Will suppress bermudagrass and johnsongrass; consider adding triclopyr ester to improve suppression. Application rate depends on tiller stage of target weed. May be applied to newly plugged zoysiagrass. See label for information on surfactant use. Broadleaf herbicides such as 2,4-D will reduce efficacy on grassy weeds. Do not apply 5 days before or 21 days after an application od 2,4-D or similar herbicide.	A, 1
fenoxaprop (1.8 - 2 oz) + fluroxypyr ester (1.8 - 2 oz) + dicamba (1.8 - 2 oz)	Last Call	FF, KB, PR, TF, Z	grassy weeds including goosegrass and crabgrass and broadleaf weeds	Treat annual grassy weeds at the 1-leaf to 4-tiller growth stage for optimal control. Sequential applications will suppress bermudagrass; make first application in the fall. May be applied to newly plugged zoysiagrass. See label for information on surfactant use. Broadleaf herbicides such as 2,4-	A, 1 + O, 4

				D will reduce efficacy on grassy weeds. Do not apply 5 days before or 21 days after an application od 2,4-D or similar herbicide.	
flazasulfuron (0.13 - 0.75 oz)	Katana (0.5 - 3 oz)	BE, BU, CE, SS, Z	overseeded cool-season grasses, sedges, some broadleaf weeds	When applying upslope or near sensitive cool-season grasses follow label to prevent off-target movement. Use with non-ionic surfactant at 0.25% v/v. Will cause transient discoloration to seashore paspalum. Can be used at reduced rates when applied in conjunction with urea nitrogen. For spot treatment only in residential turfgrass.	B, 2
fluazifop (0.75 - 1.5 oz)	Fusilade II (3 - 6 fl oz)	TF, Z	bermudagrass suppression.	Not for use on home lawns or application to tall fescue during summer. See Ornamec for application to home lawns. Apply mid-to-late spring or mid-to-late fall for best bermudagrass suppression.	A, 1
fluazifop (see label)	Ornamec (see label)	TF, Z	bermudagrass, dallisgrass suppression	Can be applied for selective weed control in tall fescue or zoysiagrass as a spot treatment. Apply mid-to-late spring or mid-to-late fall for best bermudagrass and dallisgrass control. See label for more information.	A, 1
foramsulfuron (0.2 - 0.6 oz)	Revolver (8.8 - 26.2 oz)	BE, BU, Z	overseeded cool-season grasses, goosegrass, some broadleaf weeds	Use caution when applying upslope or near sensitive cool-season grasses. Sequential applications will control small goosegrass plants. Can be applied to ultradwarf putting	B, 2

				greens for goosegrass control follow label to prevent off-target movement. Will provide centipedegrass and dallisgrass suppression. Adjuvants such as MSO, UAN, or AMS may improve control.	
halosulfuron (0.5 - 1 oz)	Sedgehammer, Manage (0.66 - 1.33 oz)	BA, BE, CBG, CE, FF, KB, PR, TF, SA, SS, Z	sedges	Include NIS at 0.25-0.5% v/v. Apply after nutsedge has reached the 3 to 8 leaf stage.	B, 2
Imazapic (0.5 - 3 oz)	Plateau (2- 12 fl oz)	See label	Broadleaf weeds, some grassy weeds, seedhead suppression	Tolerance of improved bermuda, buffalo and centipede grasses vary widely. Best for weed control and/or seedhead suppression in low maintenance areas. Temporary yellowing may occur after application to some grasses.	B, 2
Imazaquin (6 - 8 oz)	Image 70 DG (8.6-11.4 oz)	BE, CE, SA, SS, Z	Broadleaf weeds, sedges, some grasses	Include NIS at 0.25% v/v. Do not use on St. Augustinegrass for winter weed control. When applying upslope or near sensitive cool-season grasses follow label to prevent off-target movement. This herbicide is both root and shoot absorbed. Irrigation or rainfall (0.25 to 0.5 in) within 1 to 7 days after application is suggested to improve weed control.	
Mecoprop (0.58 - 0.75 lbs)	Mecomec 2.5 (4 - 5.17 pts) Mecomec 4 (2.75 - 3.5 pts)	See label	Some broadleaf weeds	Can be applied to golf greens. Not for turf being grown for sod or seed.	O, 4
MCPA (0.27 -	Trimec Bentgrass	See label	Many broadleaf	Injury is likely to centipede and St.	O, 4

0.53 lbs) + 2,4-D (0.17 -0.33) + dicamba (0.07 - 0.14 lbs)	Formula (3-6 pts)		weeds	Augustine grasses. Can be applied to putting and bowling greens. Not for turf being grown for sod.	
MCPA ester (0.9 - 1.3 lbs) + triclopyr ester (0.09 - 0.13 lbs) + dicamba (0.09 - 0.13 lbs)	Cool Power (2.5 - 3.5 pts)	B, BA, BE, CBG, F, R, Z	Many broadleaf weeds	Use the 2.5 pt/A rate when applying to actively growing warm-season turf. The 3.5 pt/A rate can be applied to dormant warm-season turf. Do not apply to centipede or St. Augustine grasses when the air temperature exceeds 80 F, and unless injury can be tolerated.	O, 4
MCPA (0.95 - 1.4 lbs) + triclopyr ester (0.09 - 0.14 lbs) + dicamba (0.09 - 0.14 lbs)	Horsepower (2-3 pts)	B, BA, BE, CBG, F, R, Z	Many broadleaf weeds	Not for turf being grown for sod. Do not make broadcast applications to carpetgrass or St. Augustinegrass when temperatures exceeds 80 F. Do not apply to centipede or St. Augustine grasses unless injury can be tolerated.	O, 4
MCPA (0.8 - 1.5 lbs) + mecoprop (0.15 - 0.3) + dicamba (0.08 - 0.15 lbs)	Tri-Power (2- 3.9 pts)	BE, CBG, FF, KB, TF, Z	Many broadleaf weeds	Except for bermudagrass and zoysiagrass, do not apply to warm-season turfgrass unless injury can be tolerated. Do not apply to centipede or St. Augustine grasses when the air temperature exceeds 80 F.	O, 4
MCPA (1.1 - 1.4 lbs) + fluroxypyr (0.11 - .15 lbs) + triclopyr (0.10 - 0.14)	Battleship III (3-4 pts)	BA, BE, BU, CBG, CE, FF, KB, TF, Z	Many broadleaf weeds	Add an adjuvant for best results.	O, 4
MCPA (1 - 1.5 lbs) + fluroxypyr (0.10 - 0.15) + dicamba (0.10 -	ChangeUp (2-3 pts)	BA, BE, CBG, CE, F, R, SA, Z	Many broadleaf weeds	Use higher application rates for dense infestations of perennial weeds. Do not apply to Floratam St. Augustinegrass. Applications	O, 4

0.15 lbs)				to dormant bahiagrass, bermudagrass and zoysiagrass are suggested. Do not make broadcast applications to carpetgrass or St. Augustinegrass when temperatures exceeds 80 F.	
Mesotrione (0.16 - 0.25 lbs)	Tenacity (5 - 8 fl oz)	BE, BU, CE, FF, KB, PR, SA, TF	Broadleaf and grassy weeds, including nimblewill and creeping bentgrass.	Can be applied immediately prior to seeding tolerant species. Only for application to dormant bermudagrass. See label for information on tank-mixtures with simazine or atrazine. This herbicide will causes temporary bleaching (whitening) of susceptible species. Apply with NIS. Application to St. Augustinegrass restricted to sod farms only.	F2, 27
metsulfuron (0.06 - 0.6 oz)	Blade, Manor, MSM turf, others (0.125 - 1 oz)	BE, CE, FF, KB, SA, Z	broadleaf weeds, bahiagrass, ryegrass	Apply with NIS at 0.25% v/v. Use rates vary depending on turfgrass species. May cause injury to centipedegrass.	B, 2
metsulfuron (0.3 oz) + rimsulfuron (0.25 oz)	NEGATE 37WG (1.5 oz)	BE, Z	grassy and broadleaf weeds including bahiagrass	Not for use on residential properties. Use caution when applying upslope or near sensitive cool-season grasses. Apply with NIS at 0.25% v/v.	B, 2
Metribuzin (0.25 - 0.45 lbs)	Sencor (0.33 - 0.66 lbs)	BE	Some broadleaf and grassy weeds, including goosegrass	Can be applied to dormant turf. Do not make applications to dormant turf in the transition zone where stress from cold temperatures is expected. Do not apply if the mowing height is less than 0.5 inches. Not for use on turf being sold. For application by commercial applicators only.	C1, 5
penoxsulam	Sapphire	BE, CBG,	some broadleaf	May cause injury to perennial	B, 2

(0.16 - 0.9 oz)	(0.25 - 1.5 pts)	PR, TF	weeds	ryegrass and tall fescue; do not apply at > 0.5 pints/A to these species.	
pronamide (0.5 – 1.0 lbs)	Kerb 3.3 SC (1.25 - 2.5 pts. Kerb 50 WP (1 - 2 lbs)	BE, CE, SA, Z	annual grassy weeds	Restricted use pesticide. Not for use on residential sites. Provides early post emergence control of several grassy weeds. Should be activated by light rainfall or irrigation within 24 hours of application. When applying upslope of sensitive cool-season grasses follow label to prevent off-target movement. Will remove overseeded perennial ryegrass from bermudagrass slowly (4-6 weeks); apply after 50% bermudagrass greenup to prevent bermudagrass injury.	K1, 3
pyraflufen (0.015 - 0.09 oz)	Octane (0.7 - 4 oz)	BE, CBG, CE, KB, PR, SA, TF, Z	broadleaf weeds	Consider tank-mixing with synthetic auxin herbicides such as 2,4-D. For use on sod farms and established ornamental turf. Treated areas may be seeded or overseeded one day after application. See label for adjuvant information.	E, 14
Quinclorac (0.25 - 0.75 lbs)	Drive XLR8 (22 - 64 fl oz) Quinclorac 75 DF (1 lb)	Many warm- and cool-season species. See label	Many annual grassy weeds including crabgrass. Some broadleaf weeds.	Apply with MSO or other high quality surfactant. Applications to grasses at the 2-4 tiller stage may not provide complete control. Can applied be before, at or after seeding many grasses. See label for more information.	L, 21(monocot) O, 4 (dicot)
Quinclorac (0.66 - 0.75 lbs) + 2,4-D (0.88 - 1.0 lbs) + dicamba (0.11 -	Quincept (7-8 pts/A)	Many warm- and cool-season species.	Some grassy weeds such as crabgrass. Many broadleaf	Applications to grasses at the 2-4 tiller stage may not provide complete control.	L, 21(monocot) O, 4 (dicot)

0.13)		See label	weeds.		
Quinclorac (0.25 - 0.75 lbs) + mecoprop (0.13 - 0.26 lbs) + dicamba (0.03 - 0.1 lbs)	Onetime (22- 64 fl oz)	Many warm- and cool-season species. See label	Some grassy and many broadleaf weeds.	Do not apply to turfgrass grown for sod. For annual grass control, apply before plants reach the 1-tiller stage or once they have matured to 5 tillers or greater. Applications to grasses at the 2-4 tiller stage may not provide complete control.	L, 21(monocot) O, 4 (dicot)
Quinclorac (0.47 - 0.75 lbs) + sulfentrazone (0.04 - 0.06 lbs) + 2,4-D (0.55 - 0.88 lbs) + dicamba (0.06 - 0.10 lbs)	Q4 (5 - 8 pts)	BE,	Some grassy weeds, nutsedge, broadleaf weeds	See label for information about potential injury to warm-season grasses.	L, 21(monocot) O, 4 (dicot) + E, 14
MSMA (see label)	many (see label)	BE, KB, Z	some grassy and broadleaf weeds, sedges	A restricted use pesticide. See EPA legislation regarding use restrictions on different sites. As of this writing MSMA is registered for use only on golf courses and sod farms with application restrictions.	Z, 17
MSMA (1.8 - 3.1 lbs) + (0.5 - 0.9 lbs) + mecoprop (0.25 - 0.4 lbs) + dicamba (0.12 - 0.20 lbs)	Trimec Plus (8 - 13.5 pts)	BE, KB, PR, TF, Z	Grassy and broadleaf weeds	This product contains MSMA. Read the label carefully for use restrictions. Do not apply when to cool- and warm-season turfgrass when temperatures exceed 80 and 90 F, respectively.	O, 4 + Z, 17
rimsulfuron (0.25 - 0.5 oz)	TranXit, Rimsulfuron 25 DF (1 - 2 oz)	BE, CE, Z	cool-season grasses including ryegrass, annual bluegrass, some broadleaf weeds	Do not apply to residential lawns. Can be applied to non-overseeded bermudagrass putting greens. Use caution when applying upslope or near sensitive cool-season grasses. May cause injury to centipedegrass.	B, 2

sethoxydim (0.19 - 0.47 lbs)	Segment (1.5 - 3.75 pts)	CE, FF	Grassy weeds including bahiagrass and bermudagrass suppression.	Can be applied to seedling centipedegrass and fine fescue. Tank mixture with some broadleaf herbicide can result in failure to control grassy weeds.	A, 1
sulfentrazone (2 - 6 oz)	Dismiss (4 - 12 fl oz)	Most warm- and cool-season grasses. See label	Broadleaf weeds, sedges. Pre-emergence control of sedges.	May cause temporary discoloration to exposed St. Augustine or zoysiagrass leaves that will recover after new growth.	E, 14
sulfentrazone (2-6 oz) + metsulfuron (0.2 - 0.6 oz)	Blindside (3.25 - 10 oz)	BE, BU, CE, KB, TF, SA, Z	Broadleaf weeds, some grasses, sedges	This herbicide may temporarily discolor or cause necrosis to some turfgrass after application. Do not apply within 7 days of trinexapac-ethyl application.	E, 14 + B, 2
sulfentrazone (0.19 lbs - 0.38 lbs) + quinclorac (0.75 - 1.5 lbs)	Solitare (1-2 lbs)	BE, BU, CE, KB, PR, TF, SS, Z	Broadleaf weeds, some grasses including crabgrass, sedges	Applications within 7 days of trinexapac-ethyl are not recommended.	E, 14 + L, 21 (monocot) O, 4 (dicot)
sulfentrazone (0.25 - 0.37 lbs) + imazethapyr (0.05 - 0.08 lbs)	Dismiss South (9.5 - 14.4 fl oz)	BA, BE, BU, CE, Z	Broadleaf weeds, sedges	Can cause temporary turfgrass discoloration. Imazethapyr has foliar and soil activity. Adequate soil moisture will improve weed control.	E, 14 + B, 2
sulfentrazone (0.02 - 0.03 lbs) + 2,4-D (0.5 - 0.7 lbs) + mecoprop (0.17 - 0.25 lbs) + dicamba (0.08 - 0.11 lbs)	Surge (2.75 - 4 pts)	B, BA, BE, BU, CBG, CE, FF, PR, R, TF, Z	Broadleaf weeds	None	E, 14 + O, 4

sulfosulfuron (0.56 - 1.50 oz)	Certainty (0.75 - 2.0 oz)	BE, BA, BU, CE, SA, SS, Z	Broadleaf, grassy, sedges	Use a non-ionic surfactant at 0.25 - 0.5% v/v. Controls tall fescue, rescuegrass and other cool-season grasses. This product is no longer registered for use in cool-season turfgrasses.	B, 2
thiencarbazone (0.01 - 0.03 oz) + iodosulfuron (0.02 - 0.06 oz) + dicamba (0.31 - 1 oz)	Celsius (2.5 - 4.9 oz)	BE, BU, CE, SA, Z	Broadleaf, grassy weeds	When applying upslope of sensitive cool-season grasses follow label to prevent off-target movement. See label for more information about adjuvant selection and spot treatment rates.	B, 2 + O, 4
thiencarbazone (0.01 - 0.03 oz) + foramsulfuron (0.02 - 0.06 oz) + halosulfuron (0.31 - 1 oz)	Tribute total (1 - 3.2 oz)	BE, Z	Broadleaf, grassy, sedges	When applying upslope of sensitive cool-season grasses follow label to prevent off-target movement. Can be used to remove overseeded cool-season species. See label for more information about adjuvant selection and spot treatment rates.	B, 2
topramezone (0.35 - 0.53 oz)	Pylex (1 - 1.5 fl oz)	CE, CBG, FF, KB, TF, PR	Several grassy and broadleaf weeds including common bermudagrass and nimblewill.	CBG is tolerant to applications at less than 0.25 fl oz/A. Can be applied any time prior to seeding tolerant turfgrasses. See label for surfactant information. This herbicide will causes temporary bleaching (whitening) of susceptible species. See label for tank-mix partners to reduce bleaching.	F2, 27
triclopyr butoxyethyl ester (0.13 - 0.25 lbs) +	T-Zone (2 - 4 pts)	BA, BE, FF, PR, R, TF, Z	Broadleaf weeds	See label for information on adjuvant use. Do not apply to warm-season turfgrass unless	O, 4 + E, 14

sulfentrazone (0.02 - 0.03 lbs) + 2,4-D ester (0.4 - 0.9 lbs) + dicamba (0.05 - 0.1 lbs)				injury can be toleranted. See label for drift management BMP's.	
triclopyr ester (0.5 - 1 lbs)	Turflon Ester, Turflon Ester Ultra (1-2 pts)	B, PR, TF	Broadleaf weeds	Can suppress bermudagrass and kikuyugrass. Do not use on warm-season turfgrass unless injury can be tolerated.	O, 4
triclopyr (0.3 - 0.6 lbs) + clopyralid (0.1 - 0.2)	Confront (1-2 pts)	BA, BE, BU, CBG, CE, FF, KB, PR, TF, Z	Broadleaf weeds.	Not for use in residential turfgrass. Do not collect clippings for mulch or compost. Do not apply to warm-season turfgrass unless injury can be tolerated; see label for more details. Do not apply to bermudagrass on sod farms.	O, 4
trifloxysulfuron (0.075 - 0.4 oz)	Monument (0.1 - 0.53 oz)	BE, Z	Grassy weeds, sedges, some broadleaf weeds	Can suppress dallisgrass, bahiagrass and torpedograss. Use for removal of overseeded ryegrass an poa trivialis. Apply with NIS at 0.5 % v/v. When applying upslope or near sensitive cool-season grasses follow label to prevent off-target movement.	B, 2
florasulam (0.2 oz)	Defendor (4 fl oz)	BA, BE, CBG, CE, FF, KB, PR, SA, TF, SS, Z	Some broadleaf weeds	Sequential applications must be made on at least a 4 week interval. This herbicide will be packaged with Dimension 2 EW.	B, 2

Table 17. Turfgrass Tolerance to Post-Emergence Herbicides registered for use in Texas turfgrasses.									
	Warm-season						Cool-season		
Herbicide common name (Trade name)	Bermudagrass	Buffalograss	Centipedegrass	Seashore paspalum	St. Augustinegrass	Zoysia	Kentucky Bluegrass	Perennial Ryegrass	Tall Fescue
2,4-D (Hardball, Weedar 64, others)	T		NR		NR	T	T	T	T
2,4-D + clopyralid + dicamba (Millennium Ultra 2[1])	T[2]		NR		NR	T	T	T	T
2,4-D + dicamba + quinclorac (2 DQ)	T		T[4]		T[4]	T	T	T	T
2,4-D + fluroxypyr + dicamba (Escalade 2)	T		NR		NR	T	T	T	T
2,4-D + MCPA + dicamba (EndRun)	T	T			NR	T	T	T	T
MCPA, mecoprop + dicamba (Tri-Power)	T		I		I	T	T	T	T
2,4-D + mecoprop + dicamba (Trimec Classic)	T	T	I		I	T	T	T	T
2,4-D + mecoprop + dicamba (Triplet SF, Triplet Low Odor)	T		I		I	T	T	T	T
2,4-D + mecoprop + dicamba + pyraflufen (4-Speed)	T					T	T	T	T
2,4-D + triclopyr + dicamba + pyraflufen (4-speed XT)	T			NR		T	T	T	T
2,4-D + mecoprop + dichlorprop (Spoiler)	T					T	T	T	T

2,4-D + mecoprop + dichlorprop (Triamine)	T		I		I	T	T	T	T
2,4-D + quinclorac + dicamba (Quincept)	I		NR	NR	NR	I	T	T	T
amicarbazone (Xonerate)	T	T	T	T	T	T	T	T	T
asulam (Asulox[1,2])	I[2]	NR	NR	NR	I	NR	NR	NR	NR
atrazine (Aatrex, Image, Scotts Bonus S)	T[3]		T		T	T	NR	NR	NR
Bentazon (Basagran)	T	T	T		T	T	T	T	T
bispyribac-sodium (Velocity)	T[5]	NR	NR	NR	NR	NR	NR	I	NR
bromoxynil (Buctril[1])	T				T	T	T	T	T
carfentrazone (Quicksilver)									
carfentrazone + 2,4-D + mecoprop + dicamba (SpeedZone Southern)	T	T	I	I	I	T	T	T	T
carfentrazone + 2,4-D + mecoprop + dicamba (SpeedZone)	T	T			NR	T	T	T	T
carfentrazone + MCPA + mecoprop + dicamba (PowerZone)	T					T	T	T	T
carfentrazone + quinclorac (SquareOne)	I	T	T	T	NR	T	T	T	T
chlorsulfuron (Corsair)	T	T	T	T	T	T	T	NR	NR
clopyralid (Clean Slate[1], Lontrel[1])	T	T	T		T	T	T	T	T
dicamba (Banvel, Vanquish, Vision, others)	T	I			I	T	T	T	T
diclofop (Illoxan)	I	NR	NR	NR	NR	NR	NR	NR	NR
ethofumesate (Prograss)	I			T	T		T	T	T
fenoxaprop (Acclaim Extra)	NR					T	T	T	T

fenoxaprop + fluroxypyr + dicamba (Last Call)	NR	NR	NR	NR	NR	T	T	T	T
flazasulfuron (Katana)	T	T	T	T	NR	T	NR	NR	NR
florasulam (Defendor)	T		T	T	T	T	T	T	T
fluazifop (Fusilade II[1], Ornamec)	NR	NR	NR	NR	NR	I	NR	NR	I
foramsulfuron (Revolver)	T	T				T			
halosulfuron (Sedgehammer)	T		T	T	T	T	T	T	T
imazapic (Plateau[1])	I	T				NR	NR	NR	I
MCPA + fluroxypyr + dicamba (Change Up)	T	T	I		I	T	T	T	T
MCPA + fluroxypyr + triclopyr (Battleship III)	T	T	T	NR	NR	T	T	T	T
MCPA + triclopyr + dicamba (Cool Power)	I		I		I	T	T	T	T
MCPA + triclopyr + dicamba (Horsepower)	I		I		I	T	T	T	T
mecoprop + 2,4-D + dicamba (Trimec Bentgrass)	T		I		I		T	T	T
mecoprop + 2,4-D + dicamba (Trimec South)	T	T	I		I	T	T	T	T
mesotrione (Tenacity)	NR	T	T	NR	I	NR	T	T	T
metribuzin (Sencor)	T	NR	NR	NR	NR	NR	NR	NR	NR
metsulfuron (Blade, Manor, MSM Turf)	T	T	I		T	T	T	NR	NR
MSMA[1,2] (many)	T		NR		NR	T	T		I
penoxsulam (LockUp, Sapphire)	T		T[2]			T	T	T	T
pronamide (Kerb[1])	T		T		T	T	NR	NR	NR
pyraflufen-ethyl (Octane)	T		T		T	T	T	T	T
quinclorac (Drive XLR8, Quinclorac 75 DF)	T[1]	T	NR	I	NR	T	T	T	T

quinclorac + mecoprop + dicamba (Onetime)	T[1]	T	NR	I	NR	T	T	T	T
quinclorac + sulfentrazone + 2,4-D + dicamba (Q4)	I					I	T	T	T
rimsulfuron (TranXit, Rimsulfuron 25 DF[1])	T		I			T	NR	NR	NR
rimsulfuron + metsulfuron (NEGATE[1])	T					T	NR	NR	NR
sethoxydim (Segment)	NR	NR	T	NR	NR	NR	NR	NR	NR
simazine (Princep)	T[3]		T		T	T[3]	NR	NR	NR
sulfentrazone (Dismiss)	T	T	T	T	T	T	T	T	T
sulfentrazone + 2,4-D + mecoprop + dicamba (Surge)	T	T	I		NR	T	T	T	T
sulfentrazone + imazethapyr (Dismiss South)	T	T	T	NR	NR	T	NR	NR	NR
sulfentrazone + metsulfuron (Blindside)	T	T	T	NR	T	T	I	NR	I
sulfentrazone + quinclorac (Solitare)	I	T	T	T	NR	T	T	T	T
sulfosulfuron (Certainty)	T	T	T	T	T-I	T	NR	NR	NR
thiencarbazone + foramsulfuron + halosulfuron (Tribute Total)	T	NR	NR	NR	NR	T	NR	NR	NR
thiencarbazone + iodosulfuron + dicamba (Celsius)	T	T	T		T	T	NR	NR	NR
topramezone (Pylex)	NR	NR	NR	NR	NR	NR	T	T	T
triclopyr (Turflon Ester Ultra, others)	I		I		I	I	T	T	T
triclopyr + clopyralid (Confront)	I	I	I		I	I	T	T	T
triclopyr + sulfentrazone + 2,4-D + dicamba (T-zone)	I				NR	T	T	T	T

trifloxysulfuron (Monument)	T	NR	NR	NR	NR	T	NR	NR	NR

Tolerance Key
T = Tolerant – Herbicide not expected to cause injury when applied at recommended rate according to the product label
I = Intermediate – Herbicide may cause injury. Consider spot treatments or testing a small area before making broadcast application.
NR = Not registered – This product is not registered on this species and/or may cause significant injury
ND = Label does not specify

[1] Not for use on residential turfgrass
[2] May cause injury to hybrid bermudagrass
[3] Restricted use herbicide. See label for more information about application restrictions.
[4] For use on dormant turfgrass; otherwise injury may occur
[5] Registered only for use in bermudagrass overseeded with perennial ryegrass

Table 18. Non-selective post-emergence herbicides registered for use in Texas Turfgrasses.				
Common Name	Trade Name Formulation (product/A)	Weeds Controlled	Comments	HRAC Group
dazomet (216 - 500 lbs)	Basamid (218 - 525 lbs)	Existing and un-germinated weeds, nematodes, fungi. A soil sterilant	See label regarding site preparation, use rates, tarping and overhead irrigation after application. Tarping may improve efficacy. A restricted use pesticide.	Z, 17
diquat (0.25 - 0.5 lbs)	Reward 2L (1-2 pts)	exisiting vegetation	Provides rapid dessication of green tissues. Adequate spray volume is essential to obtain leaf coverage and best control. Does not translocate and will not provide long-term control of many weeds.	D, 22
glufosinate (0.5 - 1.5 lbs)	Finale (2-6 qts)	existing vegetation	Translocation more limited than that of glyphosate; thus, it is excellent for edging around desirable turfgrass. Can be applied to dormant bermudagrass.	H, 10
glyphosate (see label)	RoundUp, Touchdown, others (see label)	exisiting vegetation	Optimal for control of grasses and many broadleaf plants. Does not provide complete control of legumes or cyperaceae (sedges and kyllingas).	G, 9
pelargonic acid (see label)	Scythe 4.2 L (see label)	existing vegetation	Provides rapid dessication of green tissues. Adequate spray volume is essential to obtain leaf coverage and best control. Does not translocate and will not provide long-term control of many weeds.	Z, 17

Insect and Mite Control in Texas Turfgrasses

Turfgrass insects are often encountered by turfgrass producers and managers in Texas and must be controlled in order to maintain production, harvest, delivery, and ultimate success at planting. The pests in Table 19 were identified by university and industry personnel at the Southern IPM meeting held in College Station, Texas on October 23rd, 2014 as the most common turfgrass insects found in Texas turfgrasses. Table 19 includes notes on frequency of occurrence, available effective controls, and a general ranking of the most problematic insects based on occurrence.

Table 19. Problematic Insects in Texas Turfgrass Production and Management[1]

Insect	Latin Name	Occurrence	Available Effective Control	Major Pests
Ag termites	*Nasutitermes sp.*	Occasional	Yes	
Bermudagrass Mites	*Eriophyes cynodoniensis*	Common	No	
Bermudagrass Scales	*Odonaspis ruthae*	Occasional	Yes	
Black Turfgrass Ataenius	*Ataenius spretulus*	Occasional	Yes	
Cicada Killers	*Sphecius speciosus*	Occasional	Yes	
Black Cutworms	*Agrostis ipsilon* *Other species also present	Common	Yes	
Fall Armyworms	*Spodoptera frugiperda*	Common	Yes	Yes
Ground Pearls	*Margarodes* spp.	Occasional	No	
Hunting Billbugs	*Sphenophorus venatus vestitus*	Common	Yes	
Leaf Cutter Ants	*Atta texana*	Occasional	Yes, but difficult	
Red Imported Fire Ants	*Solenopsis invicta*	Common	Yes	Yes
Rhodesgrass Mealybugs	*Antonina graminis*	Occasional	Yes	
Sod Webworms	*Toumeyella liriodendra* *Other species also present	Common	Yes	
Southern Chinch Bugs	*Blissus insularis*	Common	Yes	Yes
Southern Mole Crickets	*Scapteriscus borellii*	Common	Yes	Yes
Sugarcane Beetles	*Eutheoloa humilis*	Occasional	Yes	
Tawny Mole Crickets	*Scapteriscus vicinus*	Common	Yes	Yes
White Grubs	*Phyllophaga* spp.	Common	Yes	Yes

[1]These pests were identified by the Southern IPM Pest Management Working Group in a meeting held in College Station, TX on October 23rd, 2014.

Descriptions of Major Insect Pests in Texas Turfgrass Production

Insect Name: Red Imported Fire Ants, *Solenopsis invicta*


Photo by Casey Reynolds, PhD

Description: Red imported fire ants belong to the insect order Hymenoptera (ants, bees, and wasps) and family Formicidae (ants). They go through complete metamorphosis. Red imported fire ants are social insects that build mounds as they form their subterranean homes. A typical fire ant mound measures 6 inches in diameter, 12 inches high and can go as deep as 4 feet deep into the soil. The reproductive females (AKA the queen) are red-brown and shed their wings after their mating flights. The reproductive males are black, with wings. The sterile female workers vary in length from 1.5 to 4 mm depending on their task and are reddish brown in color, with a darker abdomen. Mating flights occur from April through August, or whenever a new colony is necessary. After mating, the males die and the female sheds her wings and searches for an appropriate place to begin the new colony. Once a location is selected she will burrow into the soil to a depth of 10 cm and construct an egg chamber. She will tend the eggs and the larvae as they emerge, until they develop into adult ants (this takes about 3 to 4 weeks). After the initial workers develop they begin tending to the queen, who can produce as many as 200 eggs per day. These eggs hatch, and the workers tend to the larvae as well. Within 2 to 3 months of colony initiation the original workers are replaced by what are called “minor” workers and in 5 months - 1 year those workers are replaced by “major” workers. These major workers gather food for the larvae, other workers, and the queen. They also defend the colony and take care of the larvae. Worker ants live about 8 weeks and queens survive 5 years or more. Colonies are typically considered mature after 3 years.

Distribution and Host Plants: Red imported fire ants are currently in 11 states, including: Alabama, Arkansas, Georgia, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas. All sunny, turfgrass areas can be suitable for red imported fire ant habitat, regardless of turfgrass species.

Damage: The red imported fire ant mounds can be large and unsightly in a managed turfgrass setting. They also can be destructive to mowers by dulling the blades if one is accidentally mowed over. They also deliver a painful sting that some people can be highly allergic to, which requires medical attention to treat.

Insect Name: Southern Chinch Bug *Blissus insularis*

Description: Southern chinch bugs belong to the insect order Heteroptera (true bugs) and family Lygaeidae (chinch bugs). They go through incomplete metamorphosis. The adult southern chinch bug is 3 to 3.6 mm in length with a black body and shiny white wings. Their wings are folded over their body and have a black triangle-shaped spot on each. There can be 3 to 6 generations each year. During the winter months, adults are the most common life stage. In the spring, when temperatures increase, 1st instar nymphs begin to appear. Chinch bugs have 5 instars growing from 0.9 to 2.97 mm. Each instar can be determined by morphological characteristics. The 1st instar has a yellow head and thorax, followed by a white band, and reddish abdomen. The head of the 1st instar is wider or equal in width to the thorax width. The 2nd instar has a yellow head and thorax, followed by a white band, and a yellow abdomen. The head of the 2nd instar is narrower than the thorax width. The 3rd instar has a yellowish-brown head and thorax, followed by a white band, and a yellowish-brown abdomen, they also have wing pads present on their thorax. The 4th instar has a brown-black head and thorax, followed by a white band, and a brown-black abdomen; the wing pads extend over the abdomen, but no further than the white band. The 5th instar has a black head and thorax, followed by a white band, and a black abdomen; the wing pads extend over the abdomen and white band on thorax. The adults disperse mainly by walking from infested areas. They mate and the females lay eggs in the crevices of grass nodes and at the junction of blades and stems. The eggs will hatch in about 2 weeks depending on temperature and the 1st instar nymphs begin to feed on basal growth and nodes of runners. Nymphal feeding will continue until the final molt to adult. All chinch bug life stages can be found in the thatch zone and at the base of the turfgrass plant.

Distribution and Host Plants: The southern chinch bug occurs from southern North Carolina, through South Carolina, Georgia, Florida, and west through Alabama, Mississippi, Louisiana, and Texas. St. Augustinegrass is the preferred host plant, but they can also feed to some extent on centipedegrass, zoysiagrass, bahiagrass and bermudagrass. However feeding on these other grass species is typically only found when they are grown in close proximity to St. Augustinegrass.

Damage: Southern chinch bugs cause damage by sucking the sap from the nodes and bottom portions of the turfgrass plant. This causes the turf to appear stunted, turn yellow, and eventually die. Damage can occur from spring to fall and is most apparent during dry conditions.

Insect Name: Tawny Mole Cricket, *Scapteriscus vicinus* and Southern Mole Cricket *S. borellii*

Description: Mole crickets belong to the insect order Orthoptera (grasshoppers, crickets and katydids) and family Gryllotalpidae (mole crickets). They go through incomplete metamorphosis. The adult cricket of both species looks fairly similar. Their bodies are well adapted for burrowing through the soil with their shovel-like forelegs and an enlarged, heavily protected prothorax for shaping and packing the soil. Their wings overlap and are shorter than the abdomen. Both are about 1.25 inches long and about 0.4 inches wide. The tawny mole cricket is slightly larger and more robust than the southern mole cricket. The tawny mole cricket is golden brown with a spotty brown pronotum. The southern mole cricket is grayish brown and four pale spots on the pronotum. The majority of the tawny mole cricket population will overwinter as adults, while the majority of the southern mole cricket population will overwinter as nymphs. Both species exhibit one generation per year. In spring, the adults of both species mate and lay eggs from April to July. The first instar mole crickets are about 6 mm long and look very similar in form to the adult cricket except their wings are not fully formed. Immediately upon hatching the young mole cricket nymphs begin feeding on roots, organic matter, other insects, and other small organisms. They are thought to go through six to eight nymphal instars and will either go through a final molt to adult or remain in the nymph stage to overwinter depending on species.

Distribution and Host Plants: Both species are found in North and South Carolina, Mississippi, Louisiana, Florida, and Texas. Bahiagrass and bermudagrass are the two grass species damaged most severely by both species, but zoysiagrass, centipedegrass, and bentgrass also experience damage.

Damage: The most severe damage occurs during late summer and early fall, when the nymphs are approaching maturity and are actively foraging for food. The tawny mole cricket primarily feeds on the turfgrass while the southern mole cricket is primarily a predator of soil dwelling arthropods. Both cause extensive surface tunnels that uproot and desiccate the turfgrass.

Insect Name: Fall Armyworm, *Spodoptera frugiperda*

Description: Armyworms belong to the insect order Lepidoptera (moths and butterflies) and family Noctuidae (night flying moths). They go through complete metamorphosis. Fall armyworm adults are generally gray in color with white markings, which includes a white teardrop-shaped light mark on the forewing. The adult moths are very susceptible to the cold, but can overwinter in Texas. All life stages can be found during the entire year. The moths fly and mate at night, after which the female will lay about 1,000 eggs in masses on structures near turfgrass. The adults live about 1 to 3 weeks and take 23 to 28 days to complete a generation. The eggs hatch and the 1st instar caterpillars (larva) emerge and begin feeding. They range in color from pinkish to yellowish, greenish, and dull gray to almost black. The top of their heads will have a light-colored (typically yellowish) inverted Y (image above). They typically feed at night and will go through two more molts before pupating into the adult moth and starting the lifecycle over.

Distribution and Host Plants: Fall armyworms occur throughout the east coast, through the southern and Gulf States into Arizona and the southern tip of California as well as northward, east of the Rocky Mountains, to Canada. The caterpillars prefer to feed on bermudagrass, fescue, ryegrass, and bluegrass.

Damage: Damage by fall armyworm caterpillars initially appears at the tips of the grass blades where they appear transparent where the plant cells have been eaten. If left uncontrolled, the caterpillars will continue feeding and leave large areas of dead turf adjacent to healthy turf, and usually there is a sharp distinct line between damaged and undamaged areas. Damage to bermudagrass often resembles drought stress, but can be recovered after treatment. However, feeding on newly established ryegrass or fescue may cause stunting of the plant or eventual death if left untreated.

Insect Name: May/June Beetles, *Phyllophaga* spp.

Description: The May/June beetles belong to the insect order Coleoptera (beetles) and family Scarabaeidae (scarab beetles). They go through complete metamorphosis. Texas has over a 100 different species, with *P. crinita* being the most serious turfgrass pest. *Phyllophaga congrua* also has been noted to damage tall fescue stands in Texas. The adult beetle is a heavy, clumsy-looking beetle, ranging in color from light or dark brown to mahogany brown. They range in size from 0.4 to 0.9 inches long. The life cycles of May/June beetles varies from 1 to 4 years for one generation (typically 1 to 2 years in Texas), depending on species and latitude. The most damaging species in Texas, *P. crinita*, has a one-year life cycle. They overwinter as third instar white grubs (larva) and pupate to adults in the spring. The adults occur from June into August where they will oviposit eggs, which hatch into 1st instar grubs which feed on the turfgrass and go through two molts before winter. All white grubs are creamy-white in color, C-shaped, with a brown head capsule and three pairs of legs (image above). Full-grown white grubs are 1 to 1.5 inches long and can be identified from other white grub species by their raster pattern. For May/June beetles that exhibit a two year life cycle the white grubs will either molt twice during the first year to overwinter as 3rd instars, or will molt once the first year to overwinter as 2nd instars which will molt again the second year and overwinter as 3rd instars. After overwintering, the 3rd instars will migrate towards the turfgrass surface to begin feeding again and then will return to deeper in the soil profile to hibernate. After an approximately 2 month pupal period, the adults emerge in July and begin to oviposit eggs. Those eggs hatch in August, molt to 2nd instars in September, and migrate down in the soil in October to overwinter.

Distribution and Host Plants: May/June beetles occur from the eastern half of the United States, through the mid-West and into Texas. The adult beetles feed on shade and forest trees, although ornamental shrubs and a few fruit trees are occasionally damaged. The larval stage (white grubs) feed on roots of perennial turfgrasses.

Damage: Damage by May/June beetle grubs is typical of that caused by other scarab beetles which is large patches of dead turfgrass due to continued feeding on the roots. Damage is most severe when the grubs are in their 3rd instar. This feeding desiccates the turfgrass plant. Severely damaged turfgrass can be rolled up- like a carpet.

Table 20. Insecticide Resistance Action Committee (IRAC) Mode of Action Classification for Insecticides		
Group	Mode of Action (MOA)[1]	Sub-Group
1	Acetylcholinesterase (AChE) inhibitors	1A: Carbamates
		1B: Organophosphates
2	GABA-gated chloride channel antagonists	2A: Cyclodiene Organochlorines
		2B: Phenylpyrazoles
3	Sodium channel modulators	3A: Pyrethroids, Pyrethrins
		3B: DDT, Methoxychlor
4	Nicotinic acetylcholine receptor (nAChR) agonists	4A: Neonicotinoids
		4B: Nicotine
		4C: Sulfoxaflor
5	Nicotinic acetylcholine receptor (nAChR) allosteric modulators	5: Spinosyns
6	Chloride channel activators	6: Avermectins, Milbemycins
7	Juvenile hormone mimics	7A: Juvenile hormone analogues
		7B: Fenoxycarb
		7C: Pyriproxyfen
8	Miscellaneous non-specific (multi-site) inhibitors	8A: Alkyl halides
		8B: Chloropicrin
		8C: Sulfuryl flouride
		8D: Borax
		8E: Tartar emetic
9	Selective homopteran feeding blockers	9B: Pymetrozine
		9C: Flonicamid
10	Mite growth inhibitors	10A: Clofentezine, Hexythiazox
		10B: Etoxazole
11	Microbial disruptors of insect midgut	11A: *Bacillus thuringiensis*
		11B: *Bacillus sphaericus*
12	Mitochondrial ATP synthase inhibitors	12A: Diafenthiuron
		12B: Organotin miticides
		12C: Propargite
		12D: Tetradifon
13	Uncouplers of oxidative phosphorylation via disruption of proton gradient	13: Pyrroles, Dinitrophenols, Sulfluramid
14	Nicotinic acetylcholine receptor (nAChR) channel blockers	14: Nereistoxin analogues
15	Chitin biosynthesis inhibitors, type 0	15: Benzoylureas
16	Chitin biosynthesis inhibitors, type 1	16: Buprofezin
17	Moulting disruptor, Dipteran	17: Cyromazine
18	Ecdysone receptor agonists	18: Diacyl-hydrazines
19	Octopamine receptor agonists	19: Amitraz
20	Mitochondrial complex III electron transport inhibitors	20A: Hydramethylon
		20B: Acequinocyl
		20C: Fluacrypyrim
21	Mitochondrial complex I electron transport	21A: METI acaricides and

	inhibitors	insecticides
		21B: Rotenone
22	Voltage-dependent sodium channel blockers	22A: Indoxacarb
		22B: Metaflumizone
23	Inhibitors of acetyl CoA carboxylase	23: Tetronic & Tetramic acid derivatives
24	Mitochondrial complex IV electron transport inhibitors	24A: Phosphine 24B: Cyanide
25	Mitochondrial complex II electron transport inhibitors	25: *beta*-Ketonitrile derivatives
28	Ryanodine receptor modulators	28: Diamides
UN	Compounds of unknown or uncertain modes of action	
[1]Successive generations of a pest should not be treated with compounds from the same MOA group		
For more information on insecticide chemistry and modes of action, please visit: www.IRAC-online.com		

Table 21. Turfgrass Insecticide Recommendations for Insects in Texas Turfgrasses						
Pest	Active Ingredient	Trade Name	Product/Acre	Product/1,000 ft^2	Insecticide Group	Notes
Ants	Acephate	Acephate 90 Prill			1B	IMT^2: See Label
(Consult label for specific species)		Acephate 90-SP				IMT^2: See Label
		Acephate 97				
		Acephate 97 UP				IMT^2: See Label
		Bracket 97				IMT^2: See Label
		Orthene-T, T&O Spray 97				IMT^2: See Label
	Bifenthrin	Bifen 2 AG Gold		0.16 to 0.32 fl. oz.	3	Restricted Use Pesticide
		Brigade 2EC	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	8.7 to 17.42 fl. oz.	0.2 to 0.4 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	40 fl. oz.	1.0 fl. oz.		Restricted Use Pesticide
		Pro-Mate Bifenthrin		0.5 to 1.0 fl. oz.		
		Sniper	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide
		Tailgunner	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.5 to 1.0 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 to 20 fl. oz.;	0.25 to 0.5 fl. oz.;		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star GC	100 to 200 lb.	2.3 to 4.6 lb.		Restricted Use Pesticide
		Up-Star Gold	n/a	0.5 to 1.0 fl. oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 to 0.5 fl.oz.	10 to 20 fl. oz.		Restricted Use Pesticide
	Carbaryl	Carbaryl 4L	2.0 to 4.0 qt.	1.5 to 3.0 fl. oz.	1A	Spot treatments only in residential turf
		Sevin SL	2.0 to 4.0 qt.	1.5 to 3.0 fl. oz.		

	Chlopyrifos	Chlorpyrifos 4E AG	1.0 qt.	0.75 fl. oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Dursban 50W-WSP	2.0 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt..	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 pt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf

						courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide
		Tempo SC Ultra	6 to 12 fl. oz.	0.13 to 0.27 fl. oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WP	7.7 to 15.4 oz.	5 to 10 grams		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WSP		See label		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
	Deltamethrin	Deltagard G	87 to 131 lb.	2 to 3 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb.	2 to 3 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	17.5 to 26 fl. Oz	0.4 to 0.6 fl. oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb.	2 to 3 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	17.5 to 25.6 fl. Oz.	0.4 to 0.6 fl. oz.		NR[1] for use on sod farms
		Suspend SC	17.5 to 26 fl. oz	0.4 to 0.6 fl. oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam Liquid	4.9 pt.	1.8 fl. oz.	4A	
	Fenoxycarb	Award	1 to 1.5 lb.		7B	
		Award II	1 lb			NR[1] for use on sod farms; IMT[2]: See label
	Fipronil	Topchoice	87	2	2B	Nuisance ants
	Hydramethylnon	Amdro Pro	1.0 to 1.5 lb.; Bigheaded ants: 1.0 to 2.0 lb.	2.0 to 3.0 oz; Bigheaded Ants: 2.0 to 4.0 oz.	20A	IMT[2]: See Label
	Imidacloprid +	Allectus G	75 to 125 lb.	1.7 to 2.9 lb.	4A and 3	NR[1] for use on golf

	Bifenthrin					courses and sod farms
		Allectus GC	75 to 125 lb.	1.7 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	3.6 to 4.5 pt.	1.32 to 1.65 fl. oz.		NR[1] for use on golf courses and sod farms
	Indoxacarb	Advion Insect Granule	50 to 200 lb.	1.15 to 4.6 lb.	22A	NR[1] for use on sod farms
	Lambda-cyhalothrin	Demand G	88 to 131 lb.	2 to 3 lb.	3	NR[1] for use on golf courses and sod farms
		Nufarm Lambda-Cyhalothrin 1 EC		See label		Restricted Use Pesticide
		Scimitar CS	5 to 10 fl. oz.	3.4 to 7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	5 to 10 fl. oz.	3.4 to 7 mL		Restricted Use Pesticide
	Permethrin	Permethrin 3.2 EC		0.4 to 0.8 fl. oz.	3	Restricted Use Pesticide
		Perm-Up 3.2 EC		0.4 to 0.8 fl. oz.		Restricted Use Pesticide
	(S)-Methoprene	Extinguish Plus	1 to 2 lb.		7A 20A	IMT[2]: See Label
	Spinosad	Seduce	See label	See label	5	IMT[2]: See Label
	Thiamethoxam	Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000 sq. ft.	4A	
		Meridian 25 WG	12.7 to 17 oz.	3 to 4 oz./ 10,000 sq. ft.		
	Zeta-Cypermethrin	Mustang	3.0 to 4.3 fl. oz.		3	Restricted Use Pesticide; Sod Farms Only
		Mustang Max/Maxx	2.2 to 4.0 fl.oz.			Restricted Use Pesticide; Sod Farms Only
Armyworms	Acephate	Acephate 90 Prill	1.1 to 2.7 lb.	0.4 to 1.0 oz.	1B	Golf courses and Sod farms only
		Acephate 90 WDG Insecticide	1.1 to 2.7 lb.	0.4 to 1.0 oz.		Golf courses only
		Acephate 97	1 to 2.5 lb.	0.4 to 0.9 oz		Golf courses and Sod farms only
		Acephate 97UP	1 to 2.5 lb.	0.4 to 0.9 oz		Golf courses and Sod farms only
		Bracket 90 WDG	1.1 to 2.71 lb.	0.4 to 1.0 oz.		Golf courses only

		Bracket 97	1.0 to 2.5 lb.	0.4 to 0.9 oz		Golf courses and Sod farms only
		Orthene-T, T&O Spray 97	1.0 to 2.5 lb.	0.4 to 0.9 oz		Golf courses and Sod farms only
		Orthene-T, T&O WSP	1.33 to 3.33 lb.	See label		Golf courses and Sod farms only
	Bifenthrin	Bifen 2 AG Gold		0.05 to 0.08 fl.oz.	3	Restricted Use Pesticide
		Brigade 2EC	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	2.8 to 4.35 fl.oz.	0.066 to 0.1 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 fl.oz.	0.25 fl.oz.		Restricted Use Pesticide
		Pro-Mate Bifenthrin		0.18 to 0.25 fl oz		
		Sniper	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide
		Tailgunner	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.18 to 0.25 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 fl.oz.	0.25 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star GC	50 lb.	1.15 lb.		Restricted Use Pesticide
		Up-Star Gold		0.18 to 0.25 fl.oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 fl.oz.	10 fl.oz.		Restricted Use Pesticide
	Carbaryl	Carbaryl 4L	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.	1A	Spot treatments only in residential turf
		Sevin SL	2.0 to 4.0 qt.	1.5 to 3 fl.oz.		
	Chlorantraniliprole	Acelepryn	2.0 to 4.0 fl oz	0.046 to 0.092 fl.oz.	28	
		Acelepryn G	50 to 100 lb.	1.15 to 2.3 lb.		
	Chlorpyrifos	Chlorpyrifos 4E	1.0 qt.	0.75 fl.oz.	1B	Restricted Use Pesticide;

		AG				Sod Farms Only
		Dursban 50W-WSP	2.0 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 pt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide: NR[1] for use on golf

						courses and sod farms
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide
		Tempo SC Ultra	6.0 to 12 fl.oz.	0.135 to 0.270 fl.oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WP	7.7 to 15.4 oz.	5 to 10 grams		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WSP		See label		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
	Deltamethrin	Deltagard G	87 to 131 lb.	2 to 3 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb.	2 to 3 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	8.75 to 17.5 fl.oz.	0.2 to 0.4 fl.oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb.	2 to 3 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	8.75 to 17.5 fl.oz.	0.2 to 0.4 fl.oz.		NR[1] for use on sod farms
		Suspend SC	17.5 to 26 fl. Oz	0.4 to 0.6 fl.oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam Liquid	4.9 pt.	1.8 fl.oz.	4A	
	Imidacloprid + Bifenthrin	Allectus G	50 to 125 lb.	1.2 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC SC	1.8 to 4.5 pt.	0.67 to 1.65 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC	50 to 125 lb.	1.1 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	1.1 to 4.5 pt.	0.4 to 1.65 fl.oz.		NR[1] for use on golf courses and sod farms
	Indoxacarb	Provaunt	2.0 to 4.0 oz.	0.046 to 0.092 oz.	22A	NR[1] for use on sod farms

	Lambda-cyhalothrin	Demand G	88 to 131 lb.	2 to 3 lb.	3	NR[1] for use on golf courses and sod farms
		Nufarm Lambda-Cyhalothrin 1 EC		See label		Restricted Use Pesticide
		Scimitar CS	5.0 to 10 fl.oz.	3.4 to 7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	5.0 to 10 fl.oz.	3.4 to 7 mL		Restricted Use Pesticide
	Permethrin	Permethrin 3.2 EC		0.4 to 0.8 fl.oz.	3	Restricted Use Pesticide
		Perm-Up 3.2 EC		0.4 to 0.8 fl.oz.		Restricted Use Pesticide
	Spinosad	Blackhawk	1.1 to 2.2 oz.		5	Sod farms only
		Conserve SC	10 fl.oz.	0.25 fl.oz.		
		Tracer	1.0 to 2.0 fl.oz.			Sod farms only
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms
	Zeta-Cypermethrin	Mustang	3.0 to 4.3 fl. oz.		3	Restricted Use Pesticide; Sod Farms Only
		Mustang Max/Maxx	2.8 to 4.0 oz.			Restricted Use Pesticide; Sod Farms Only
Billbugs	Bifenthrin	Bifen 2 AG Gold		0.08 to 0.16 fl.oz.	3	Restricted Use Pesticide
		Brigade 2EC	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	4.35 to 8.7 fl.oz.	0.1 to 0.2 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 to 20 fl.oz.	0.25 to 0.5 fl.oz.		Restricted Use Pesticide
		Pro-mate Bifenthrin		0.25 to 0.5 fl. oz.		
		Sniper	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide
		Tailgunner	3.7 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.25 to 0.5 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 to 20 fl.oz.	0.25 to 0.5 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod

						Farms Only
		Up-Star GC	50 to 100 lb	1.15 to 2.3 lb.		Restricted Use Pesticide
		Up-Star Gold		0.25 to 0.5 fl.oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 to 0.5 fl.oz.	10 to 20 fl.oz.		Restricted Use Pesticide
	Chlorantraniliprole	Acelepryn	8.0 to 20 fl.oz.	0.184 to 0.46 fl .oz.	28	
		Acelepryn G	50 to 100 lb	1.15 to 2.3 lb.		
	Chlorpyrifos	Chlorpyrifos 4E AG	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Dursban 50W-WSP	2.0 to 4.0 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	0.75 to 3 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 to 4.0 pt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only

		Yuma 4E	1.0 to 2.0 qt.	0.75 to 1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Deltamethrin	Deltagard G	87 to 131 lb	2.0 to 3.0 lb	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb	2.0 to 3.0 lb		Restricted Use Pesticide
		Deltagard GC 5SC	26 to 39 fl.oz.	0.6 to 0.9 fl.oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb	2.0 to 3.0 lb		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	26 to 39 fl.oz.	0.6 to 0.9 fl.oz.		NR[1] for use on sod farms
		Suspend SC	26 to 39 fl.oz.	0.6 to 0.9 fl.oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam Liquid	4.9 pt.	1.8 fl.oz.	4A	
		Zylam 20SG	2.7 lb.	1 oz.		
	Imidacloprid (larvae only)	Amtide Imidacloprid 2F T&O	19.2 to 25.6 fl.oz.	0.45 to 0.6 fl.oz.	4A	
		Criterion 0.5 G	60 to 80 lb	1.4 to 1.8 lb		NR[1] for use on sod farms
		Criterion 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Criterion 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Malice 0.5G	50 to 80 lb.	1.2 to 1.8 lb.		NR[1] for use on sod farms
		Malice 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		NR[1] for use on sod farms
		Malice 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Mallet 0.5G	60 to 80 lb	1.4 to 1.8 lb		NR[1] for use on sod farms

		Mallet 2F T&O	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Mallet 75WSP	4 to 5.375 packets (6.4 to 8.6 oz)	1 packet (1.6oz.)/ 8,250 to 11,000 sq. ft.		NR[1] for use on sod farms
		Merit 0.5G	60 to 80 lb	1.4 to 1.8 lb		NR[1] for use on sod farms
		Merit 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Merit 75WP	6.4 to 8.6oz.	3 to 4 level teaspoons		
		Merit 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		NR[1] for use on sod farms
		Pro-mate Merit 0.2%	150 to 200 lb	3.5 to 4.5 lb		
		Prokoz Zenith 0.5 G	60 to 80 lb	1.4 to 1.8 lb		NR[1] for use on sod farms
		Prokoz Zenith 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Prokoz Zenith 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
	Imidacloprid + Bifenthrin	Allectus G	75 to 125 lb.	1.7 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC SC	2.3 to 4.5 pt.	0.9 to 1.65 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC	75 to 125 lb.	1.7 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	1.1 to 4.5 pt.	0.4 to 1.65 fl.oz.		NR[1] for use on golf courses and sod farms
	Lambda-cyhalothrin	Demand G	131 to 176 lb	3.0 to 4.0 lb.	3	NR[1] for use on golf courses and sod farms
	Thiamethoxam	Meridian 25 WG	12.7 to 17 oz.	3 to 4oz./ 10,000 sq. ft.	4A	
		Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000 sq. ft.		
Black Turfgrass	Bifenthrin	Bifen 2 AG Gold		0.08 to 0.16 fl.oz.	3	Restricted Use Pesticide

Ataenius		Brigade 2EC	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Bifen 2 AG Gold		0.08 to 0.16 fl.oz.		Restricted Use Pesticide
		Brigade 2EC	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	4.35 to 8.7 fl oz	0.1 to 0.2 fl oz		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	3.5 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 to 20 fl.oz.	0.25 to 0.5 fl.oz.		Restricted Use Pesticide
		Sniper	3.5 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide
		Tailgunner	3.7 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.25 to 0.5 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 to 20 fl. oz.	0.25 to 0.5 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star GC	50 to 100 lb	1.15 to 2.3 lb.		Restricted Use Pesticide
		Up-Star Gold		0.18 to 0.25 fl.oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 to 0.5 fl.oz.	10 to 20 fl. oz.		Restricted Use Pesticide
	Chlorpyrifos	Chlorpyrifos 4E AG	2 to 4 qt.	1.5 to 3 fl. oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	2 to 4 qt.	1.5 to 3 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	2 to 4 qt.	1.5 to 3 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	1.5 to 3 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians

						Only
		Govern 4E	2 to 4 qt.	1.5 to 3 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	2 to 4 qt.	1.5 to 3 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Vulcan	1.0 qt.	1.5 to 3 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	4.0 pt.	1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	2 to 4 qt.	1.5 to 3 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide
		Tempo SC Ultra	12 fl. oz.	0.27 fl. oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WP	15.4 oz.	10 grams		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WSP		See label		Landscape and Recreational Turf Only: NR[1] for use on golf

						courses and sod farms
	Deltamethrin	Deltagard G	87 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb.	2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb.	2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		NR[1] for use on sod farms
		Suspend SC	26 to 39 fl.oz.	0.6 to 0.9 fl.oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam Liquid	4.9 pt.	1.8 fl. oz.	4A	
		Zylam 20SG	2.7 lb.	1.0 oz.		
	Imidacloprid (larvae only)	Amtide Imidacloprid 2F T&O	19.2 to 25.6 fl. oz.	0.45 to 0.6 fl.oz.	4A	
		Criterion 0.5 G	60 to 80 lb	1.4 to 1.8 lb		NR[1] for use on sod farms; Larvae only
		Criterion 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Criterion 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Malice 0.5G	50 to 80 lb.	1.2 to 1.8 lb.		NR[1] for use on sod farms
		Malice 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		NR[1] for use on sod farms
		Malice 75 WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Mallet 0.5G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Mallet 2 F T&O	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Mallet 75 WSP	4 to 5.375 packets (6.4 to 8.6 oz)	1 packet (1.6oz.)/ 8,250 to 11,000 sq. ft.		NR[1] for use on sod farms
		Merit 0.5G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Merit 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Merit 75WP	6.4 to 8.6 oz.	3 to 4 level teaspoons		

		Merit 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Pro-mate Merit 0.2%	150 to 200 lb	3.5 to 4.5 lb		
		Prokoz Zenith 0.5 G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Prokoz Zenith 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Prokoz Zenith 75 WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
	Imidacloprid + Bifenthrin	Allectus G	100 to 125 lb.	2.3 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	100 to 125 lb.	2.3 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC SC	3.6 to 4.5 pt.	1.32 to 1.65 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	3.6 to 4.5 pt.	1.32 to 1.65 fl. oz.		NR[1] for use on golf courses and sod farms
	Lambda-cyhalothrin	Nufarm Lambda-Cyhalothrin 1 EC		See label	3	Restricted Use Pesticide
		Scimitar CS	10 fl. oz.	7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	10 fl. oz.	7 mL		Restricted Use Pesticide
	Thiamethoxam	Meridian 25 WG	12.7 to 17 oz.	3.0 to 4.0 oz./ 10,000 sq. ft.	4A	
		Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000 sq. ft.		
	Spinosad	Conserve SC	52 fl. oz.	1.2fl. oz.	5	
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms
Chinch bugs	Acephate	Acephate 90 Prill	GC: 2.7 to 4.3 lb.; SFT: 2.7 to 3.2 lb.	GC: 1.0 to 1.6 oz.; SFT: 1.0 to 1.2 oz.	1B	Golf courses and Sod farms only
		Acephate 90	2.7 to 4.4 lb	1.0 to 1.6 oz.		Golf courses only

		WDG Insecticide				
		Acephate 97	GC: 2.5 to 4.12 lb.; SF: 2.5 to 3.09 lb.	GC: 0.9 to 1.5 oz.; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only
		Acephate 97UP	GC: 2.5 to 4.12 lb.; SF: 2.5 to 3.09 lb.	GC: 0.9 to 1.5 oz.; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only
		Bracket 90 WDG	2.71 to 4.44 lb.	1.0 to 1.6 oz.		Golf courses only
		Bracket 97	GC: 2.5 to 4.12 lb.; SF: 2.5 to 3.09 lb.	GC: 0.9 to 1.5 oz.; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only
		Orthene-T, T&O Spray 97	GC: 2.5 to 4 lb.; SF: 2.5 to 3 lb.	GC: 0.9 to 1.5 oz; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only
		Orthene-T, T&O WSP	3.3 to 4 lbs	1.3 to 1.5 oz		Golf courses and Sod farms only
	Bifenthrin	Bifen 2 AG Gold		0.16 to 0.32 fl.oz.	3	Restricted Use Pesticide
		Brigade 2EC	7.0 to 14.0 fl.oz.	0.16 to 0.32 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	8.7 to 17.42 fl.oz.	0.2 to 0.4 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	7.0 to 14.0 fl.oz.	0.16 to 0.32 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 to 20 fl.oz.	0.25 to 0.5 fl.oz.		Restricted Use Pesticide
		Pro-Mate Bifenthrin		0.5 to 1.0 fl oz.		
		Sniper	7.0 to 14.0 fl.oz.	0.16 to 0.32 fl.oz.		Restricted Use Pesticide
		Tailgunner	7.0 to 14.0 fl.oz.	0.16 to 0.32 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.5 to 1.0 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 to 20 fl.oz.	0.25 to 0.5 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star GC	100 to 200 lb.	2.3 to 4.6 lb.		Restricted Use Pesticide
		Up-Star Gold		0.25 to 0.5 fl.oz.		Lawns, parks, and athletic

						fields
		Up-Star SC	0.25 to 0.5 fl.oz.	10 to 20 fl.oz.		Restricted Use Pesticide
	Carbaryl	Carbaryl 4L	6.0 to 8.0 qt..	4.4 to 6.0 fl.oz.	1A	Spot treatments only in residential turf
		Sevin SL	6.0 to 8.0 qt..	4.4 to 6.0 fl.oz.		
	Chlorantraniliprole	Acelepryn	8.0 to 20 fl.oz.	0.184 to 0.46 fl.oz.	28	Suppression Only.
		Acelepryn G	50 to 100 lb.	1.15 to 2.3 lb.		Suppression Only.
	Chlorpyrifos	Chlorpyrifos 4E AG	1.0 qt.	0.75 fl.oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Dursban 50W-WSP	2.0 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt..	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 pt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide;

						Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide
		Tempo SC Ultra	12 fl.oz.	0.27 fl.oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WP	15.4 oz.	10 grams		Landscape and Recreational Turf Only: NR1 for use on golf courses and sod farms
		Tempo Ultra WSP		See label		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
	Deltamethrin	Deltagard G	87 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb.	2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	26 to 39 fl.oz.	0.6 to 0.9 fl.oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb.	2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	26 to 39 fl.oz.	0.6 to 0.9 fl.oz.		NR[1] for use on sod farms
		Suspend SC	26 to 39 fl.oz.	0.6 to 0.9 fl.oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam 20SG	2.7 lb.	1.0 oz.	4A	
		Zylam Liquid	4.9 pt.	1.8 fl.oz.		
	Imidacloprid	Amtide Imidacloprid 2F	25.6 fl.oz.	0.6 fl.oz.	4A	Suppression Only.

		T&O				
		Criterion 0.5 G	80 lb.	1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Criterion 2F	1.6 pt.	0.6 fl.oz.		Suppression Only
		Criterion 75WSP		1.6 oz. (1 packet) / 8,250 sq. ft.		Suppression Only
		Malice 0.5G	80 lb.	1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Malice 2F	1.6 pt.	0.60 fl.oz.		NR[1] for use on sod farms; Suppression Only
		Malice 75 WSP		1.6oz. (1 packet) / 8,250 sq. ft.		Suppression Only
		Mallet 0.5G	80 lb.	1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Mallet 2 F T&O	1.6 pt.	0.60 fl.oz.		Suppression Only
		Mallet 75 WSP	5.375 packets (8.6 oz)	1 packet (1.6oz.)/ 8,250 sq. ft.		NR[1] for use on sod farms; Suppression Only
		Merit 0.5G	80 lb.	1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Merit 2F	1.6 pt.	0.6 fl.oz.		Suppression Only
		Merit 75WP	8.6 oz.	4 level teaspoons		Suppression Only
		Merit 75WSP		1.6oz. (1 packet) / 8,250 sq. ft.		Suppression Only
		Pro-mate Merit 0.2%	200 lb.	4.5 lb.		Suppression Only
		Prokoz Zenith 0.5 G	80 lb.	1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Prokoz Zenith 2F	1.6 pt	0.6 fl.oz.		Suppression Only
		Prokoz Zenith 75 WSP		1.6oz. (1 packet) / 8,250 sq. ft.		Suppression Only
	Imidacloprid + Bifenthrin	Allectus G	75 to 125 lb.	1.7 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC SC	2.3 to 4.5 pt.	0.9 to 1.65 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC	75 to 125 lb.	1.7 to 2.9 lb.		Restricted Use Pesticide;

						Golf Courses and Sod Farms Only
		Allectus SC	1.1 to 4.5 pt.	0.4 to 1.65 fl.oz.		NR[1] for use on golf courses and sod farms
	Lambda-cyhalothrin	Nufarm Lambda-Cyhalothrin 1 EC		See label	3	Restricted Use Pesticide
		Demand G	131 to 176 lb.	3 to 4 lb.		NR[1] for use on golf courses and sod farms
		Scimitar CS	10 fl.oz.	7 mL		NR[1] for use on golf courses and sod farms
	Permethrin	Permethrin 3.2 EC		0.4 to 0.8 fl.oz.	3	Restricted Use Pesticide
		Perm-Up 3.2 EC		0.4 to 0.8 fl.oz.		Restricted Use Pesticide
	Thiamethoxam	Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000 sq. ft.	4A	
		Meridian 25 WG	12.7 to 17 oz.	3 to 4oz./ 10,000 sq. ft.		
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms
	Zeta-Cypermethrin	Mustang	3.0 to 4.3 fl. oz.		3	Restricted Use Pesticide; Sod Farms Only
		Mustang Max/Maxx	2.8 to 4.0 fl. oz.			Restricted Use Pesticide; Sod Farms Only
Cutworms	Acephate	Acephate 90 Prill	GC: 2.7 to 4.3 lb.; SFT: 2.7 to 3.2 lb.	GC: 1.0 to 1.6 oz.; SFT: 1.0 to 1.2 oz.	1B	Golf courses and Sod farms only
		Acephate 90 WDG Insecticide	2.71 to 4.44 lb.	1.0 to 1.6 oz.		Golf courses only
		Acephate 97	GC: 2.5 to 4.12 lb.; SF: 2.5 to 3.09 lb.	GC: 0.9 to 1.5 oz.; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only
		Acephate 97UP	GC: 2.5 to 4.12 lb.; SF: 2.5 to 3.09 lb.	GC: 0.9 to 1.5 oz.; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only
		Bracket 90 WDG	2.71 to 4.44 lb.	1.0 to 1.6 oz.		Golf courses only
		Bracket 97	GC: 2.5 to 4.12 lb.; SF: 2.5 to 3.09 lb.	GC: 0.9 to 1.5 oz.; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only

		Orthene-T, T&O Spray 97	1.0 to 2.5 lb.	0.4 to 0.9 oz		Golf courses and Sod farms only
		Orthene-T, T&O WSP	1.33 to 3.33 lb.	GC: 0.5 to 1.2 oz.; SF: 0.5 to 1.3 oz.		Golf courses and Sod farms only
	Bifenthrin	Bifen 2 AG Gold		0.05 to 0.08 fl.oz.	3	Restricted Use Pesticide
		Brigade 2EC	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	2.8 to 4.35 fl.oz.	0.066 to 0.1 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 fl.oz.	0.25 fl.oz.		Restricted Use Pesticide
		Pro-Mate Bifenthrin		0.18 to 0.25 fl oz.		
		Sniper	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide
		Tailgunner	2.2 to 3.5 fl.oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.18 to 0.25 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 fl.oz.	0.25 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star GC	50 lb.	1.15 lb.		Restricted Use Pesticide
		Up-Star Gold		0.18 to 0.25 fl.oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 fl.oz.	10 fl.oz.		Restricted Use Pesticide
	Carbaryl	Carbaryl 4L	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.	1A	Spot treatments only in residential turf
		Sevin SL	2.0 to 4.0 qt.	1 1/2 to 3 fl.oz.		
	Chlorantraniliprole	Acelepryn	2.0 to 4.0 fl.oz.	0.046 to 0.092 fl.oz.	28	
		Acelepryn G	50 to 100 lb.	1.15 to 2.3 lb.		
	Chlorpyrifos	Chlorpyrifos 4E AG	1.0 qt.	0.75 fl.oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Dursban 50W-	2.0 lb.			Restricted Use Pesticide;

		WSP				Sod Farms Only
		Govern 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 pt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl.oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide

		Tempo SC Ultra	6.0 to 12 fl.oz.	0.135 to 0.270 fl.oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WSP		See label		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WP	7.7 to 15.4 oz.	5 to 10 grams		Landscape and Recreational Turf Only: NR1 for use on golf courses and sod farms
	Deltamethrin	Deltagard G	87 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb.	2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	8.75 to 17.5 fl.oz.	0.2 to 0.4 fl.oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb.	2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	8.75 to 17.5 fl.oz.	0.2 to 0.4 fl.oz.		NR[1] for use on sod farms
		Suspend SC	17.5 to 26 fl. Oz	0.4 to 0.6 fl.oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam 20SG	2.7 lb.	1.0 oz.	4A	
		Zylam Liquid	4.9 pt.	1.8 fl.oz.		
	Imidacloprid	Amtide Imidacloprid 2F T&O	19.2 to 25.6 fl.oz.	0.45 to 0.6 fl.oz.	4A	Suppression Only
		Criterion 0.5 G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Criterion 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		Suppression Only
		Criterion 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		Suppression Only
		Malice 0.5G	50 to 80 lb.	1.2 to 1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Malice 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		NR[1] for use on sod farms;

						Suppression Only
		Malice 75 WSP		1.6oz. (1 packet) / 8,250 to 11,000 sq. ft.		Suppression Only
		Mallet 0.5G	80 lb.	1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Mallet 2 F T&O	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Mallet 75WSP	4 to 5.375 packets (6.4 to 8.6 oz)	1 packet (1.6oz.)/ 8,250 to 11,000 sq. ft.		NR[1] for use on sod farms; Suppression Only
		Merit 0.5G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Merit 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		Suppression Only
		Merit 75WP	6.4 to 8.6oz.	3 to 4 level teaspoons		Suppression Only
		Merit 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		Suppression Only
		Prokoz Zenith 0.5 G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms; Suppression Only
		Prokoz Zenith 2F	1.6 pt	0.6 fl.oz.		Suppression Only
		Prokoz Zenith 75 WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		Suppression Only
	Imidacloprid + Bifenthrin	Allectus G	50 to 125 lb.	1.2 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	50 to 125 lb.	1.1 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC SC	1.8 to 4.5 pt.	0.67 to 1.65 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	1.1 to 4.5 pt.	0.4 to 1.65 fl.oz.		NR[1] for use on golf courses and sod farms
	Indoxacarb	Provaunt	2.0 to 4.0 oz.	0.046 to 0.092oz.	22A	NR[1] for use on sod farms
	Lambda-cyhalothrin	Demand G	88 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf

						courses and sod farms
		Nufarm Lambda-Cyhalothrin 1 EC		See label		Restricted Use Pesticide
		Scimitar CS	5 to 10 fl.oz.	3.4 to 7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	5 to 10 fl.oz.	3.4 to 7 mL		Restricted Use Pesticide
	Spinosad	Conserve SC	35 - 52 fl.oz.	0.8 - 1.2 fl.oz.		
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms
	Zeta-Cypermethrin	Mustang	3.0 to 4.3 fl. oz.		3	Restricted Use Pesticide; Sod Farms Only
		Mustang Max/Maxx	2.24 to 4.0 oz.			Restricted Use Pesticide; Sod Farms Only
Green June Beetle Grubs	Carbaryl	Carbaryl 4L	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.	1A	Spot treatments only in residential turf
		Sevin SL	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.		
	Chlorpyrifos	Chlorpyrifos 4E AG	1.0 qt.	0.75 fl.oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Dursban 50W-WSP	2.0 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only

		Vulcan	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 pt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl.oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Dinotefuran	Zylam Liquid	4.9 pt.	1.8 fl.oz.	4A	Suppression Only.
		Zylam 20SG	2.7 lb.	1.0 oz.		
	Imidacloprid	Amtide Imidacloprid 2F T&O	19.2 to 25.6 fl. oz.	0.45 to 0.6 fl.oz.	4A	
		Criterion 0.5 G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Criterion 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Criterion 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Malice 0.5G	50 to 80 lb.	1.2 to 1.8 lb.		NR[1] for use on sod farms
		Malice 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		NR[1] for use on sod farms
		Malice 75 WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Mallet 0.5G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Mallet 2 F T&O	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		

		Mallet 75 WSP	4 to 5.375 packets (6.4 to 8.6 oz)	1 packet (1.6oz.)/ 8,250 to 11,000 sq. ft.		NR[1] for use on sod farms
		Merit 0.5G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Merit 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Merit 75WP	6.4 to 8.6 oz.	3 to 4 level teaspoons		
		Merit 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Pro-mate Merit 0.2%	150 to 200 lb	3.5 to 4.5 lb		
		Prokoz Zenith 0.5 G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Prokoz Zenith 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Prokoz Zenith 75 WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
	Imidacloprid + Bifenthrin	Allectus G	100 to 125 lb.	2.3 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	100 to 125 lb.	2.3 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC SC	3.6 to 4.5 pt.	1.32 to 1.65 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	3.6 to 4.5 pt.	1.32 to 1.65 fl.oz.		NR[1] for use on golf courses and sod farms
	Lambda-cyhalothrin	Demand G	131 to 176 lb.	3.0 to 4.0 lb.	3	NR[1] for use on golf courses and sod farms; Suppression Only
		Scimitar CS	10 fl. oz.	7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	10 fl. oz.	7 mL		Restricted Use Pesticide; Suppression Only
	Thiamethoxam	Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000	4A	

				sq. ft.		
		Meridian 25 WG	12.7 to 17 oz.	3 to 4 oz./ 10,000 sq. ft.		
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms
Mealybugs	Bifenthrin	Bifen 2 AG Gold		0.08 to 0.16 fl.oz.	3	Restricted Use Pesticide
		Brigade 2EC	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Bifen 2 AG Gold		0.08 to 0.16 fl.oz.		Restricted Use Pesticide
		Brigade 2EC	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	3.5 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 to 20 fl.oz.	0.25 to 0.5 fl.oz.		Restricted Use Pesticide
		Sniper	3.5 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide
		Tailgunner	3.7 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.25 to 0.5 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 to 20 fl. oz.	0.25 to 0.5 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star GC	50 to 100 lb	1.15 to 2.3 lb.		Restricted Use Pesticide
		Up-Star Gold		0.25 to 0.5 fl. oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 to 0.5 fl.oz.	10 to 20 fl. oz.		Restricted Use Pesticide
	Deltamethrin	Deltagard G	87 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb.	2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	17.5 to 26 fl. Oz	0.4 to 0.6 fl. oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb.	2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	17.5 to 25.6 fl. oz.	0.4 to 0.6 fl. oz.		NR[1] for use on sod farms

		Suspend SC	17.5 to 26 fl. oz	0.4 to 0.6 fl. oz.		NR[1] for use on sod farms
	Imidacloprid + Bifenthrin	Allectus G	75 to 125 lb.	1.7 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	75 to 125 lb.	1.7 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC SC	2.3 to 4.5 pt.	0.9 to 1.65 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	1.1 to 4.5 pt.	0.4 to 1.65 fl.oz.		NR[1] for use on golf courses and sod farms
	Zeta-Cypermethrin	Mustang	3.0 to 4.3 oz.		3	Restricted Use Pesticide; Sod Farms Only
		Mustang Max/Maxx	2.8 to 4.0 oz.			Restricted Use Pesticide; Sod Farms Only
Mites	Bifenthrin	Bifen 2 AG Gold	n/a	0.08 to 0.16 fl.oz.	3	Restricted Use Pesticide
		Brigade 2EC	3.5 to 7.0 fl.oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	4.35 to 8.7 fl oz	0.1 to 0.2 fl oz		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	3.5 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 to 20 fl. oz.	0.25 to 0.5 fl. oz.		Restricted Use Pesticide
		Pro-Mate Bifenthrin		0.25 to 0.5 fl. oz.		
		Sniper	3.5 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide
		Tailgunner	3.7 to 7.0 fl. oz.	0.08 to 0.16 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.25 to 0.5 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 to 20 fl. oz.	0.25 to 0.5 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star SC	0.25 to 0.5 fl.oz.	10 to 20 fl. oz.		Restricted Use Pesticide
	Chlorpyrifos	Chlorpyrifos 4E	1.0 qts.	0.75 fl. oz.	1B	Restricted Use Pesticide;

		AG				Sod Farms Only
		Dursban 50W-WSP	2.0 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	1.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 pt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
	Deltamethrin	Deltagard G	87 to 131 lb	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb	2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		Restricted Use Pesticide; Suppression Only
		Deltagard T&O	87 to 131 lb	2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms

		Deltagard T&O 5SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		NR[1] for use on sod farms; Suppression only
		Suspend SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		NR[1] for use on sod farms; Suppression only
	Dicofol	Dicofol 4-E Miticide	0.66 to 1 pt.	0.33 or 2 tsp	2A	Sod Farms Only
	Imidacloprid + Bifenthrin	Allectus GC SC	2.3 to 4.5 pt.	0.9 to 1.65 fl. oz.	4A and 3	Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	1.1 to 4.5 pt.	0.4 to 1.65 fl. oz.		NR[1] for use on golf courses and sod farms
	Lambda-cyhalothrin	Demand G	88 to 131 lb	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Nufarm Lambda-Cyhalothrin 1 EC				Restricted Use Pesticide
		Scimitar CS	5.0 to 10 fl. oz.	3.4 to 7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	5.0 to 10 fl. oz.	3.4 to 7 mL		Restricted Use Pesticide
Mole Crickets	Acephate	Acephate 90 Prill	GC: 2.3 to 4.3 lb.; SFT: 2.3 to 3.2 lb.	GC: 0.8 to 1.6 oz.; SFT: 0.8 to 1.2 oz.	1B	Golf courses and Sod farms only
		Acephate 90 WDG Insecticide	2.22 to 4.44 lb.	0.8 to 1.6 oz.		Golf courses only
		Acephate 97	GC: 2.2 to 4 lb.; SF: 2.2 to 3.09 lb.	GC: 0.8 to 1.4 oz.; SF: 0.8 to 1.1 oz.		Golf courses and Sod farms only
		Acephate 97UP	GC: 2.2 to 4 lb.; SF: 2.2 to 3.09 lb.	GC: 0.8 to 1.4 oz.; SF: 0.8 to 1.1 oz.		Golf courses and Sod farms only
		Bracket 90 WDG	2.22 to 4.44 lb.	0.8 to 1.6 oz.		Golf courses only
		Bracket 97	GC: 2.2 to 4.0 lb.; SF: 2.2 to 3.09 lb.	GC: 0.8 to 1.4 oz.; SF: 0.8 to 1.1 oz.		Golf courses and Sod farms only
		Orthene-T, T&O Spray 97	GC: 2.5 to 4.0 lb.; SF: 2.5 to 3.0 lb.	GC: 0.9 to 1.5 oz; SF: 0.9 to 1.1 oz.		Golf courses and Sod farms only
		Orthene-T, T&O WSP	GC: 2.66 to 5.33 lb.; SF: 3.33 to 4.0 lb.	GC: 1.0 to 2.0 oz.; SF: 1.33 to 1.5 oz.		Golf courses and Sod farms only
	Bifenthrin	Bifen 2 AG Gold		0.16 to 0.32 fl. oz.	3	Restricted Use Pesticide
		Brigade 2EC	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide;

						Sod Farms Only
		Capture LFR	8.7 to 17.42 fl. oz.	0.2 to 0.4 fl. oz.		
		Fanfare ES	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 to 40 fl. oz.	0.25 to 1.0 fl. oz.		Restricted Use Pesticide
		Pro-Mate Bifenthrin		0.5 to 1.0 fl. oz.		
		Sniper	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide
		Tailgunner	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P		0.5 to 1 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 to 20 fl. oz.; Large Infestations: 40 fl. oz.	0.25 to 0.5 fl. oz.; Large Infestations: 1 fl. oz.		Restricted Use Pesticide; Golf courses and Sod farms only
		Up-Star GC	100 to 200 lb.	2.3 to 4.6 lb.		Restricted Use Pesticide
		Up-Star Gold		0.5 to 1.0 fl. oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 to 0.5 fl.oz.	10 to 20 fl. oz.		Restricted Use Pesticide
	Chlorpyrifos	Chlorpyrifos 4E AG	2.0 qt.	1.5 fl. oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Dursban 50W-WSP	2 to 4 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	2.0 qt.	1.5 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	2.0 qt.	1.5 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	2.0 qt.	1.5 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	2.0 qt.	1.5 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only

		Nufarm Chlorpyrifos SPC 4	1.0 qt.	1.5 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	2.0 qt.	1.5 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	4.0 pt.	1.5 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	2.0 qt.	1.5 fl. oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide
		Tempo SC Ultra	12 fl. oz.	0.27 fl. oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WP	15.4 oz.	10 grams		Landscape and Recreational Turf Only: NR1 for use on golf courses and sod farms
		Tempo Ultra WSP		See label		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms

	Deltamethrin	Deltagard G		2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC		2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		Restricted Use Pesticide
		Deltagard T&O		2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		NR[1] for use on sod farms
		Suspend SC	26 to 39 fl. oz.	0.6 to 0.9 fl. oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam Liquid	4.9 pt.	1.8 fl. oz.	4A	
		Zylam 20SG	2.7 lb.	1.0 oz.		
	Fipronil	Chipco Choice	12.5 to 25 lbs	4.6 to 9.4 oz.	2B	Restricted Use Pesticide; Apply using slit-placement application equipment
		Topchoice	87	2		
	Imidacloprid	Amtide Imidacloprid 2F T&O	25.6 fl. oz.	0.6 fl. oz.	4A	
		Criterion 0.5 G	80 lb.	1.8 lb.		NR[1] for use on sod farms
		Criterion 2F	1.6 pt.	0.6 fl. oz.		
		Criterion 75WSP		1.6 oz. (1 packet) / 8,250 sq. ft.		
		Malice 0.5G	80 lb.	1.8 lb.		NR[1] for use on sod farms
		Malice 2F	1.6 pt.	0.6 fl. oz.		NR[1] for use on sod farms
		Malice 75 WSP		1.6 oz. (1 packet) / 8,250 sq. ft.		
		Mallet 0.5G	80 lb.	1.8 lb.		NR[1] for use on sod farms
		Mallet 2 F T&O	1.6 pt.	0.60 fl. oz.		
		Mallet 75 WSP	5.375 packets (8.6 oz)	1 packet (1.6 oz.)/ 8,250 sq. ft.		NR[1] for use on sod farms
		Merit 0.5G	80 lb.	1.8 lb.		NR[1] for use on sod farms
		Merit 2F	1.6 pt.	0.6 fl. oz.		
		Merit 75WP	8.6 oz.	4 level teaspoons		
		Merit 75WSP		1.6 oz. (1 packet) / 8,250 sq. ft.		

		Pro-mate Merit 0.2%	200 lb.	4.5 lb.		
		Prokoz Zenith 0.5 G	80 lb.	1.8 lb.		NR[1] for use on sod farms
		Prokoz Zenith 2F	1.6 pt	0.6 fl.oz.		
		Prokoz Zenith 75 WSP		1.6 oz. (1 packet) / 8,250 sq. ft.		
	Imidacloprid + Bifenthrin	Allectus G	125 lb.	2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	125 lb.	2.9 lb.		Restricted Use Pesticide; Golf courses and Sod farms only
		Allectus GC SC	3.6 to 4.5 pt.	1.32 to 1.65 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	3.6 to 4.5 pt.	1.32 to 1.65 fl. oz.		NR[1] for use on golf courses and sod farms
	Indoxacarb	Provaunt	12 oz.	0.275 oz.	22A	NR[1] for use on sod farms
		Advion Insect Granule	50 to 200 lb.	1.15 to 4.6 lb.		NR[1] for use on sod farms
	Lambda-cyhalothrin	Demand G	131 to 176 lb.	3.0 to 4.0 lb.	3	NR[1] for use on golf courses and sod farms
		Nufarm Lambda-Cyhalothrin 1 EC		See label		Restricted Use Pesticide
		Scimitar CS	10 fl. oz.	7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	10 fl. oz.	7 mL		Restricted Use Pesticide
	Permethrin	Permethrin 3.2 EC		0.4 to 0.8 fl. oz.	3	Restricted Use Pesticide
		Perm-Up 3.2 EC		0.4 to 0.8 fl. oz.		Restricted Use Pesticide
	Thiamethoxam	Meridian 25 WG	12.7 to 17 oz.	3.0 to 4.0 oz./ 10,000 sq. ft.	4A	Suppression Only.
		Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000 sq. ft.		
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms
Red Imported	Abamectin	Optigard Fire Ant	1.0 lb.		6	IMT[2]: See Label

Fire Ants		Bait				
	Acephate	Acephate 90 Prill			1B	IMT[2]: See Label
		Acephate 90-SP				IMT[2]: See Label
		Acephate 97				IMT[2]: See Label
		Acephate 97 UP				IMT[2]: See Label
		Bracket 97				IMT[2]: See Label
		Orthene-T, T&O Spray 97				IMT[2]: See Label
		Orthene-T, T&O WSP				IMT[2]: See Label
	Bifenthrin	Bifen 2 AG Gold		0.16 to 0.32 fl. oz.	3	Restricted Use Pesticide; IMT[2]: See Label
		Brigade 2EC	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; Sod Farms Only; IMT[2]: See Label
		Capture LFR	8.7 to 17.42 fl. oz.	0.2 to 0.4 fl. oz.		Restricted Use Pesticide; Sod Farms Only; IMT[2]: See Label
		Fanfare ES	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; IMT[2]: See Label
		Menace GC 7.9% Flowable	40 fl. oz.	0.5 fl. oz.		Restricted Use Pesticide; Sod Farms Only; IMT[2]: See Label
		Pro-Mate Bifenthrin				IMT[2]: See Label
		Sniper	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; IMT[2]: See Label
		Tailgunner	7.0 to 14.0 fl. oz.	0.16 to 0.32 fl. oz.		Restricted Use Pesticide; Sod Farms Only; IMT[2]: See Label
		Talstar P	n/a	0.5 to 1 fl. oz.		Lawns, parks, and athletic fields; IMT[2]: See Label
		Talstar S Select	10 to 20 fl. oz.; Large Infestations: 40 fl. oz.	0.25 to 0.5 fl. oz.; Large Infestations: 1 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only; IMT[2]: See Label

		Up-Star GC	100 to 200 lb.	2.3 to 4.6 lb.		Restricted Use Pesticide
		Up-Star Gold		1.0 fl.oz.		Lawns, parks, and athletic fields; IMT[2]: See Label
		Up-Star SC	0.5 fl. oz.	20 fl. oz.		Restricted Use Pesticide; IMT[2]: See Label
	Carbaryl	Carbaryl 4L			1A	Spot treatments only in residential turf
		Sevin SL				IMT[2]: See Label
	Chlorpyrifos	Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.	1B	Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only; IMT[2]: See Label
		Nufarm Chlorpyrifos SPC 4	1.0 qt.			Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only; IMT[2]: See Label
	Clothianidin + Bifenthrin	Aloft GC SC	Control: 20 fl. oz.; Suppression: 14.4 fl. oz.	Control: 0.46 fl. oz.; Suppression: 0.33 fl. oz.	4A and 3	Restricted Use Pesticide; IMT[2]: See Label
		Aloft LC SC	Control: 20 fl. oz.; Suppression: 14.4 fl. oz.	Control: 0.46 fl. oz.; Suppression: 0.33 fl. oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms; IMT[2]: See Label
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide; Aids in control only.
		Tempo SC Ultra	12 fl. oz.	0.27 fl. oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms; Aids in control only.
		Tempo Ultra WP	15.4 oz.	10 grams		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms; Aids in control only.
		Tempo Ultra WSP		See label		Landscape and

						Recreational Turf Only: NR[1] for use on golf courses and sod farms; Aids in control only.
	Deltamethrin	Deltagard G	87 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms; IMT[2]: See Label
		Deltagard GC	87 to 131 lb.	2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC				Restricted Use Pesticide; IMT[2]: See Label
		Deltagard T&O	87 to 131 lb.	2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms; IMT[2]: See Label
		Deltagard T&O 5SC				NR[1] for use on sod farms; IMT[2]: See Label
		Suspend SC				NR[1] for use on sod farms; IMT[2]: See Label
	Fenoxycarb	Award	1.0 to 1.5 lb.		7B	IMT[2]: See Label
		Award II	1 lb			NR[1] for use on sod farms; IMT[2]: See Label
	Fipronil	Chipco Choice	12.5 to 25 lbs	4.6 to 9.4 oz.	2B	Restricted Use Pesticide; Apply using slit-placement application equipment; Can only be used in USDA APHIS Fire Ant Quarantine Areas
		Maxforce FC Fire Ant Bait	1.5 to 5.0 lb.	0.5 to 1.83 oz.		IMT[2]: See Label
		Topchoice	87	2		
	Hydramethylnon	Amdro Pro	1.0 to 1.5 lb.	2.0 to 3.0 oz	20A	IMT[2]: See Label
	Imidacloprid + Bifenthrin	Allectus G	125 lb.	2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	125 lb.	2.9 lb.		Restricted Use Pesticide; Golf courses and Sod farms only
		Allectus GC SC	3.6 to 4.5 pt.	1.32 to 1.65 fl. oz.		Restricted Use Pesticide;

						Golf Courses and Sod Farms Only
		Allectus SC	3.6 to 4.5 pt.	1.32 to 1.65 fl. oz.		NR[1] for use on golf courses and sod farms
	Indoxacarb	Advion Fire Ant Bait	1.5 lb.	0.5 oz.	22	NR[1] for use on sod farms; IMT[2]: See Label
	Lambda-cyhalothrin	Nufarm Lambda-Cyhalothrin 1 EC			3	Restricted Use Pesticide; IMT[2]: See Label
		Scimitar CS	5.0 to 10 fl. oz.	3.4 to 7 mL		NR[1] for use on golf courses and sod farms; IMT[2]: See Label
		Scimitar GC	5.0 to 10 fl. oz.	3.4 to 7 mL		Restricted Use Pesticide
	Metaflumizone	Siesta	1.0 to 1.5 lb.	2.0 to 3.0 oz/5,000 sq ft	22	
	Permethrin	Permethrin 3.2 EC		0.4 to 0.8 fl. oz.	3	Restricted Use Pesticide
		Perm-Up 3.2 EC		0.4 to 0.8 fl. oz.		Restricted Use Pesticide
	Pyriproxyfen	Distance Fire Ant Bait	1.0 to 1.5 lb.	0.35 to 0.5 oz.	7C	IMT[2]: See Label
	(S)-Methoprene	Extinguish	1.0 to 1.5 lb.	3.5 tablespoons	7A	IMT[2]: See Label
		Extinguish Plus	1.5 lb.			IMT[2]: See Label
	Spinosad	Conserve SC			5	IMT[2]: See Label
		Entrust/Entrust SC	See label	See label		IMT[2]: See Label
	Thiamethoxam	Meridian 25WG			4A	IMT[2]: See Label
		Meridian 0.33G				IMT[2]: See Label
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms; IMT[2]: See Label
Sod Webworms	Acephate	Acephate 90 Prill	1.1 to 2.3 lb.	0.4 to 0.8 oz.	1B	Golf courses and Sod farms only
		Acephate 90 WDG Insecticide	1.11 to 2.22 lb.	0.4 to 0.8 oz.		Golf courses only
		Acephate 97	1.0 to 2.2 lb.	0.4 to 0.8 oz.		Golf courses and Sod farms only
		Acephate 97UP	1.0 to 2.2 lb.	0.4 to 0.8 oz.		Golf courses and Sod farms only
		Bracket 90 WDG	1.11 to 2.22 lb.	0.4 to 0.8 oz.		Golf courses only
		Bracket 97	1.0 to 2.2 lb.	0.4 to 0.8 oz.		Golf courses and Sod

						farms only
		Orthene-T, T&O Spray 97	1.0 to 2.0 lb.	0.4 to 0.8 oz.		Golf courses and Sod farms only
		Orthene-T, T&O WSP	1.33 to 2.66 lb.	1/2 to 1 oz.		Golf courses and Sod farms only
	Bifenthrin	Bifen 2 AG Gold	n/a	0.05 to 0.08 fl.oz.	3	Restricted Use Pesticide
		Brigade 2EC	2.2 to 3.5 fl. oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Capture LFR	2.8 to 4.35 fl. oz.	0.066 to 0.1 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Fanfare ES	2.2 to 3.5 fl. oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Menace GC 7.9% Flowable	10 fl. oz.	0.25 fl. oz.		Restricted Use Pesticide
		Pro-Mate Bifenthrin	n/a	0.18 to 0.25 fl oz		
		Sniper	2.2 to 3.5 fl. oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide
		Tailgunner	2.2 to 3.5 fl. oz.	0.05 to 0.08 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Talstar P	n/a	0.18 to 0.25 fl. oz.		Lawns, parks, and athletic fields
		Talstar S Select	10 fl. oz.	0.25 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Up-Star GC	50 lb.	1.15 lb.		Restricted Use Pesticide
		Up-Star Gold		0.18 to 0.25 fl. oz.		Lawns, parks, and athletic fields
		Up-Star SC	0.25 fl. oz.	10 fl. oz.		Restricted Use Pesticide
	Carbaryl	Carbaryl 4L	6.0 to 8.0 qt.	4.4 to 6.0 fl. oz.	1A	Spot treatments only in residential turf
		Sevin SL	6.0 to 8.0 qt.	4.4 to 6.0 fl. oz.		
	Chlorantraniliprole	Acelepryn	2.0 to 4.0 fl. oz.	0.046 to 0.092 fl. oz.	28	
		Acelepryn G	50 to 100 lb.	1.15 to 2.3 lb.		
	Chlorpyrifos	Chlorpyrifos 4E AG	1.0 qt.	0.75 fl. oz.	1B	Restricted Use Pesticide; Sod Farms Only

		Dursban 50W-WSP	2.0 lb.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	2.0 pt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	1.0 qt.	0.75 fl. oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl. oz.		Restricted Use Pesticide: NR[1] for use on golf

						courses and sod farms
	Cyfluthrin	Tempo 20 WP-GC		See label	3	Restricted Use Pesticide
		Tempo SC Ultra	6.0 to 12 fl. oz.	0.135 to 0.270 fl. oz.		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WP	7.7 to 15.4 oz.	5 to 10 grams		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
		Tempo Ultra WSP	n/a	See label		Landscape and Recreational Turf Only: NR[1] for use on golf courses and sod farms
	Deltamethrin	Deltagard G	87 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Deltagard GC	87 to 131 lb.	2.0 to 3.0 lb.		Restricted Use Pesticide
		Deltagard GC 5SC	8.75 to 17.5 fl. oz.	0.2 to 0.4 fl. oz.		Restricted Use Pesticide
		Deltagard T&O	87 to 131 lb.	2.0 to 3.0 lb.		NR[1] for use on golf courses and sod farms
		Deltagard T&O 5SC	8.75 to 17.5 fl. oz.	0.2 to 0.4 fl. oz.		NR[1] for use on sod farms
		Suspend SC	17.5 to 26 fl. Oz	0.4 to 0.6 fl. oz.		NR[1] for use on sod farms
	Dinotefuran	Zylam Liquid	4.9 pt.	1.8 fl. oz.	4A	
		Zylam 20SG	2.7 lb.	1.0 oz.		
	Imidacloprid + Bifenthrin	Allectus G	50 to 125 lb.	1.2 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	50 to 125 lb.	1.1 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC SC	1.8 to 4.5 pt.	0.67 to 1.65 fl. oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	1.1 to 4.5 pt.	0.4 to 1.65 fl. oz.		NR[1] for use on golf courses and sod farms

	Indoxacarb	Provaunt	2.0 to 4.0 oz.	0.046 to 0.092 oz.	22A	NR[1] for use on sod farms
	Lambda-cyhalothrin	Demand G	88 to 131 lb.	2.0 to 3.0 lb.	3	NR[1] for use on golf courses and sod farms
		Nufarm Lambda-Cyhalothrin 1 EC		See label		Restricted Use Pesticide
		Scimitar CS	5.0 to 10 fl. oz.	3.4 to 7 mL		NR[1] for use on golf courses and sod farms
		Scimitar GC	5.0 to 10 fl. oz.	3.4 to 7 mL		Restricted Use Pesticide
	Methomyl	Annihilate LV Insecticide	3.0 pt.	1.1 fl. oz.	1A	Restricted Use Pesticide; Sod Farms Only
		Annihilate SP Insecticide	1.0 lb.	0.4 oz.		Restricted Use Pesticide; Sod Farms Only
		Lannate LV Insecticide	3.0 pt.	1.1 fl. oz.		Restricted Use Pesticide; Sod Farms Only
		Lannate SP	1.0 lb.	0.4 oz.		Restricted Use Pesticide; Sod Farms Only
	Permethrin	Permethrin 3.2 EC		0.4 to 0.8 fl. oz.	3	Restricted Use Pesticide
		Perm-Up 3.2 EC		0.4 to 0.8 fl. oz.		Restricted Use Pesticide
	Spinosad	Conserve SC	10 fl. oz.	0.25 fl. oz.	5	
		Blackhawk	1.1 to 2.2 oz.			Sod farms only
		Tracer	1.0 to 2.0 fl.oz.			Sod farms only
	Thiamethoxam	Meridian 25 WG	12.7 to 17 oz.	3.0 to 4.0 oz./ 10,000 sq. ft.	4A	
		Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000 sq. ft.		
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms
	Zeta-Cypermethrin	Mustang	3.0 to 4.3 oz.		3	Restricted Use Pesticide; Sod Farms Only
		Mustang Max/Maxx	2.24 to 4.0 oz.			Restricted Use Pesticide; Sod Farms Only
White grubs	Carbaryl	Carbaryl 4L	8.0 qt.	6.0 fl. oz.	1A	Spot treatments only in residential turf
		Sevin SL	8.0 qt.	6.0 fl.oz.		
	Chlorantraniliprole	Acelepryn	8.0 to 16 fl. oz.	0.184 to 0.367 fl. Oz.	28	

		Acelepryn G	50 to 100 lb.	1.15 to 2.3 lb.		
	Chlorpyrifos	Chlorpyrifos 4E AG	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.	1B	Restricted Use Pesticide; Sod Farms Only
		Dursban 50W-WSP	2.0 to 4.0 qt.			Restricted Use Pesticide; Sod Farms Only
		Govern 4E	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Hatchet	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban 4E	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Lorsban Advanced	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Nufarm Chlorpyrifos SPC 2	2.0 qt.	1.5 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Nufarm Chlorpyrifos SPC 4	1.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Vulcan	1.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide: Golf Course, Industrial Site, and Road Medians Only
		Warhawk	4.0 pt.	1.5 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Whirlwind	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide; Sod Farms Only
		Yuma 4E	2.0 to 4.0 qt.	1.5 to 3.0 fl.oz.		Restricted Use Pesticide; Sod Farms Only
	Clothianidin + Bifenthrin	Aloft GC G	80 to 160 lb.	1.8 to 3.6 lb.	4A and 3	Restricted Use Pesticide
		Aloft GC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide
		Aloft LC G	80 to 160 lb.	1.8 to 3.6 lb.		Restricted Use Pesticide: NR[1] for use on golf

						courses and sod farms
		Aloft LC SC	11.65 to 23.3 fl. oz.	0.27 to 0.54 fl.oz.		Restricted Use Pesticide: NR[1] for use on golf courses and sod farms
	Dinotefuran	Zylam 20SG	2.7 lb.	1.0 oz.	4A	
		Zylam Liquid	4.9 pt.	1.8 fl.oz.		Suppression Only.
	Imidacloprid	Amtide Imidacloprid 2F T&O	19.2 to 25.6 fl. oz.	0.45 to 0.6 fl.oz.	4A	
		Criterion 0.5 G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Criterion 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Criterion 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Malice 0.5G	50 to 80 lb.	1.2 to 1.8 lb.		NR[1] for use on sod farms
		Malice 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		NR[1] for use on sod farms
		Malice 75 WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Mallet 0.5G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Mallet 2 F T&O	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Mallet 75 WSP	4 to 5.375 packets (6.4 to 8.6 oz)	1 packet (1.6oz.)/ 8,250 to 11,000 sq. ft.		NR[1] for use on sod farms
		Merit 0.5G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Merit 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		
		Merit 75WP	6.4 to 8.6 oz.	3 to 4 level teaspoons		
		Merit 75WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
		Pro-mate Merit 0.2%	150 to 200 lb	3.5 to 4.5 lb		
		Prokoz Zenith 0.5 G	60 to 80 lb.	1.4 to 1.8 lb.		NR[1] for use on sod farms
		Prokoz Zenith 2F	1.25 to 1.6 pt	0.46 to 0.6 fl.oz.		

		Prokoz Zenith 75 WSP		1.6 oz. (1 packet) / 8,250 to 11,000 sq. ft.		
	Imidacloprid + Bifenthrin	Allectus G	100 to 125 lb.	2.3 to 2.9 lb.	4A and 3	NR[1] for use on golf courses and sod farms
		Allectus GC	100 to 125 lb.	2.3 to 2.9 lb.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus GC SC	3.6 to 4.5 pt.	1.32 to 1.65 fl.oz.		Restricted Use Pesticide; Golf Courses and Sod Farms Only
		Allectus SC	3.6 to 4.5 pt.	1.32 to 1.65 fl.oz.		NR[1] for use on golf courses and sod farms
	Lambda-cyhalothrin	Demand G	131 to 176 lb.	3 to 4 lb.	3	NR[1] for use on golf courses and sod farms; Suppression Only
		Nufarm Lambda-Cyhalothrin 1 EC		See label		Restricted Use Pesticide
		Scimitar CS	10 fl. oz.	7 mL		NR[1] for use on golf courses and sod farms; Suppression Only
		Scimitar GC	10 fl. oz.	7 mL		Restricted Use Pesticide; Suppression Only
	Thiamethoxam	Meridian 25 WG	12.7 to 17 oz.	3 to 4 oz./ 10,000 sq. ft.	4A	
		Meridian 0.33G	60 to 80 lb.	7 to 9 lb./ 5,000 sq. ft.		
	Thiamethoxam + Lambda-cyhalothrin	Tandem	See label	See label	3A and 4A	NR[1] for use on sod farms

[1]NR = Not Registered
[2]IMT = Individual Mound Treatment

Disease Control in Texas Turfgrasses

Turfgrass diseases are often encountered by turfgrass producers and managers in Texas and must be controlled in order to maintain production, harvest, delivery, and ultimate success at planting. The diseases in Table 22 were identified by university and industry personnel at the Southern IPM meeting held in College Station, Texas on October 23rd, 2014 as the most common turfgrass diseases found in Texas turfgrasses.

Table 22. Turfgrass Diseases in Texas Turfgrass Production and Management[1]

Disease	Causal Agent	Occurrence	Available Effective Control
Anthracnose	*Colletotrichum graminicola*	Occasional	Y, but difficult
Brown Patch	*Rhizoctonia solani*	Common	Y
Dollar Spot	*Sclerotinia homoeocarpa*	Common	Y
Fairy Ring	Basidomycetes	Common	Y, but difficult
Grey Leaf Spot	*Pyricularia grisea*	Common	Y
Large Patch	*Rhizoctonia solani*	Common	Y
Leaf Spots	Various types and causal agents	Common	Y
Leaf and Sheath Spot	*Rhizoctonia zea*	Occasional	Y
Microdochium patch	*Microdochium nivale*	Common	Y
Pythium diseases	*Pythium* spp.	Common	Y
Root decline	*Gaeumannomyces graminis* var. *graminis*	Common	Y, difficult
Spring Dead Spot	*Ophiosphaerella herpotrica & O. korrae*	Occasional	Y
Summer patch	*Magnaporthe poae*	Occasional	Y
Thatch Collapse disease	*Sphaerobolus stellatus*	Occasional	Y

[1]These diseases were identified by the Southern IPM Pest Management Working Group in a meeting held in College Station, TX on October 23rd, 2014.

Table 23. Turfgrass Diseases and Active Ingredients for Effective Control labeled in Texas Turfgrasses														
Active Ingredient	Anthracnose	Brown Patch	Dollar Spot	Fairy Ring	Grey Leaf Spot	Large Patch	Leaf Spots	Leaf/ Sheat Spot	Microdochium Patch	Pythium	Root Decline[1]	Spring Dead Spot	Summer Patch	Thatch Collapse
azoxystrobin	X	X		X	X	X	X	X	X	X	X	X	X	X
boscalid			X											
chloroneb		X								X				
chlorothalonil	X	X	X		X		X		X					
cyazofamid										X				
etridiazole										X				
fenarimol		X	X						X		X	X	X	
fludioxonil	X	X					X		X					
fluopicolide										X				
fluoxastrobin	X	X		X	X		X		X		X	X	X	X
flutolanil		X		X		X		X						X
fosetyl Al	X									X				
iprodione		X	X				X		X					
mancozeb		X	X		X		X		X	X				
mefenoxam										X				
metconazole	X	X	X	X	X	X			X		X		X	X
myclobutanil	X	X	X		X	X	X		X		X	X	X	
PCNB									X					
polyoxin D	X	X		X		X	X	X	X					X
propamocarb										X				
propiconazole	X	X	X		X	X	X		X			X		
pyraclostrobin	X	X		X	X	X	X	X	X	X	X		X	X
tebuconazole	X	X	X		X	X			X		X	X	X	
thiophanate - methyl	X	X	X		X	X	X		X		X	X	X	
thiram		X	X				X							
triadimefon	X	X	X		X	X			X		X		X	
trifloxystrobin	X	X			X		X		X				X	
triticonazole	X	X	X			X	X		X		X		X	
vinclozolin		X	X				X		X					

[1]Root decline includes bermudagrass decline and St. Augustinegrass decline
[2]This chart was adapted from “A Practical Guide to Turfgrass Diseases” by Richard Latin

Plant Parasitic Nematodes in Texas Turfgrasses

Plant-parasitic nematodes are un-segmented roundworms with spear-like mouthparts that can feed on turfgrass roots. Not all nematodes are problematic in turfgrasses, and many of them are actually beneficial. However, plant-parasitic species can damage turf by feeding on roots, girdling roots, or even entering turfgrass roots to feed on plant cells. Nematode species that can cause problems in warm-season turfgrasses in Texas often include sting, lance, root-knot, stubby-root, ring, sheath, sheathoid, awl, spriral, and stunt nematodes (Smiley et al., 2005).

Nematodes are often controlled by using soil fumigants immediately before planting new turfgrasses, but can also be treated after planting. Products and effectiveness vary, but nematicides include Curfew, Nortica (*Bacillus firmus* strain I-1582), Avid (abamectin), and Multiguard (furfural). Application restrictions, methods, sites, and performance of these products often vary so consult the label for specific use guidelines after a proper nematode diagnosis (Crow, 2014).

Table 24. University and Industry Personnel in the Texas Turfgrass Production and Management Industry				
Person	Organization	Specialty	Contact	Email Address
Dr. Casey Reynolds	Texas A&M University	Turfgrass	(979) 845-0603	casey.reynolds@ag.tamu.edu
Dr. Ben Wherley	Texas A&M University	Turfgrass	(979) 845-1591	b-wherley@tamu.edu
Dr. Matt Elmore	Texas A&M University	Turfgrass Weed Science	(972) 952-9219	matthew.elmore@ag.tamu.edu
Dr. Joey Young	Texas Tech University	Turfgrass	(806) 834-8457	joey.young@ttu.edu
Dr. Marco Palma	Texas A&M University	Extension Economist	(979) 845-5284	mapalma@ag.tamu.edu
Dr. Robert Puckett	Texas A&M University	Entomology	(979) 458-0853	rpuck@tamu.edu
John Cosper	Turfgrass Producers of Texas	Turfgrass Production	(979) 282-9305	tpt@txsod.com
Dr. Paul Baumann	Texas A&M University	Weed Science	(979) 845-4880	pbaumann@ag.tamu.edu
Dr. Richard White	Texas A&M University	Turfgrass	(979) 845-1550	rh-white@tamu.edu
Dr. Young-ki Jo	Texas A&M University	Plant Pathology	(979) 862-1758	ykjo@tamu.edu

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