

Turfgrass Morphology, ID and Selection

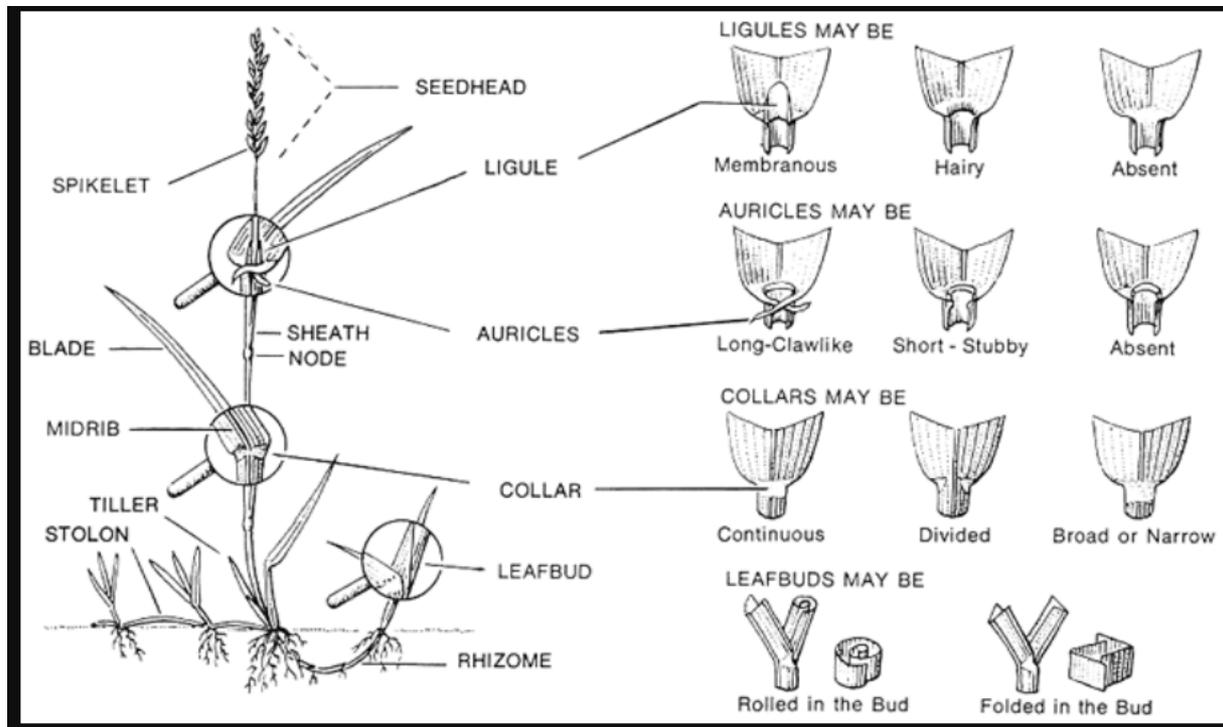
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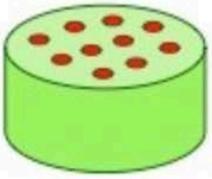
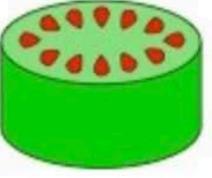


Turfgrass Morphology

Morphology: “The branch of biology that deals with the form of living organisms, and with relationships between their structures.” – Merriam-Webster

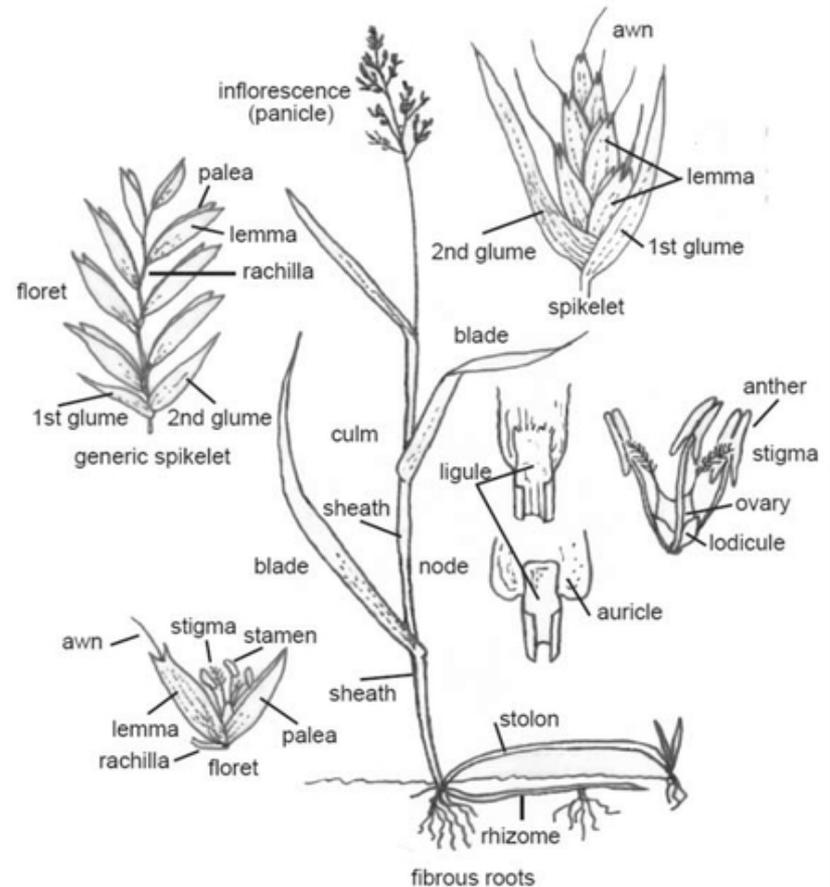


Grasses are Monocots

	Seed	Root	Vascular	Leaf	Flower
Monocot					
	One cotyledon	Fibrous roots	Scattered	Parallel veins	Multiples of 3
Dicot					
	Two cotyledon	Tap roots	Ringed	Net-like veins	4 or 5

Shoots

- Primary Shoot Components:
 - Stems
 - Leaves
 - Lateral Buds
 - Flowering Stems
 - Flower Buds



Stems

A stem is defined by Merriam-Webster as:

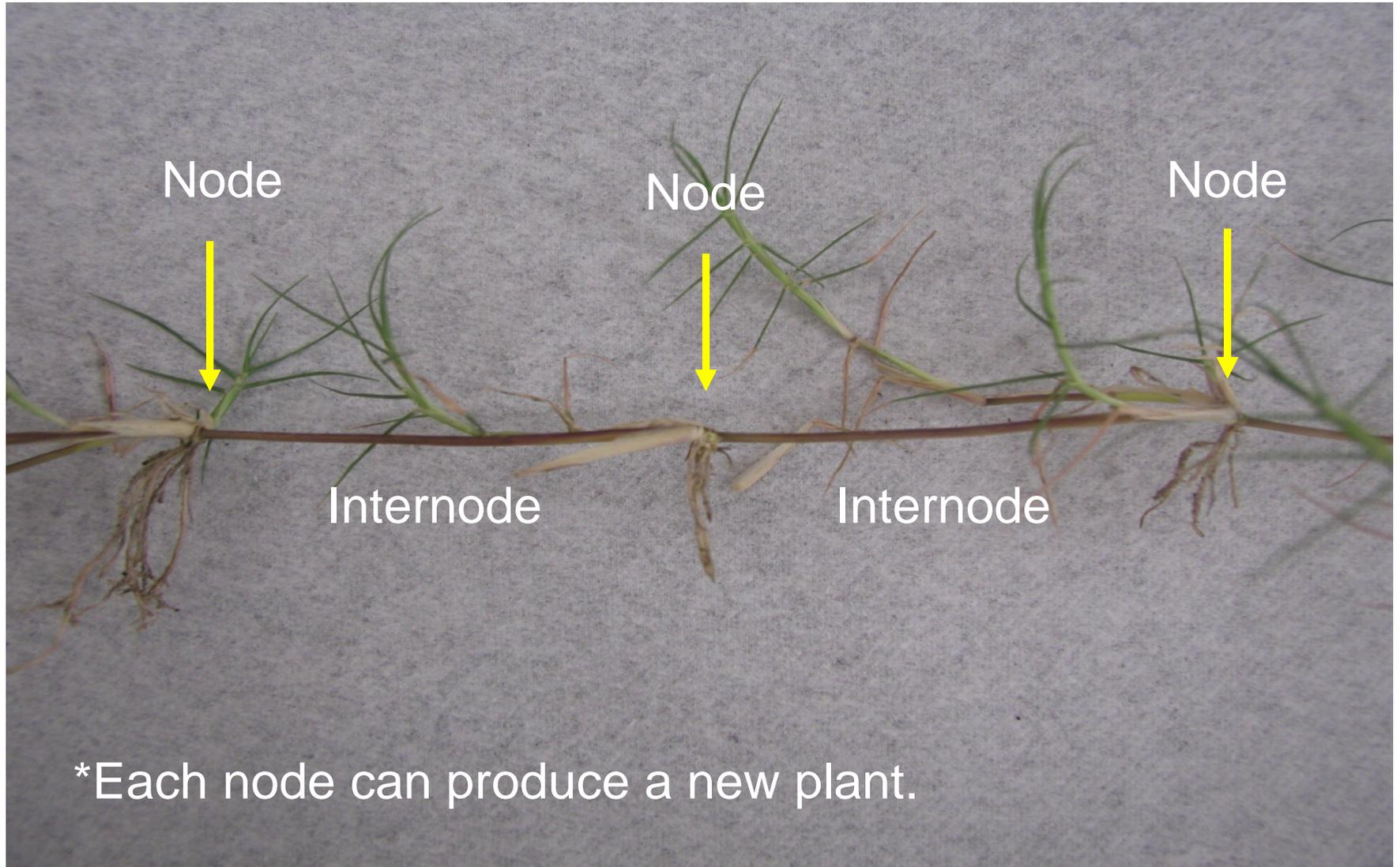
“The main trunk of a plant. Specifically, a primary plant axis that develops buds and shoots instead of roots.”

Stems will include both nodes and internodes:

Nodes are where buds and leaves originate on the stem.

Internodes are the portions of the stem between two successive nodes.

Nodes and Internodes

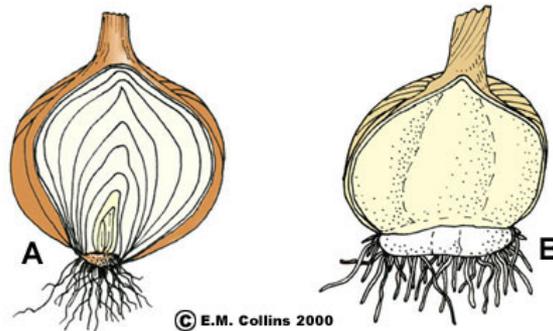


Lateral and/or Modified Stems

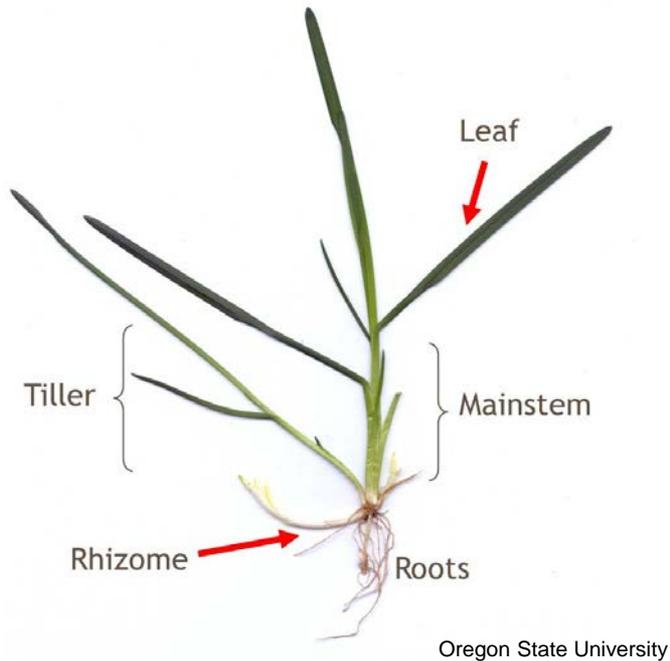
- **Tillers:** Present on all turfgrasses
- **Stolons:** Present on some turfgrasses
- **Rhizomes:** Present on some turfgrasses
- **Tubers:** Present on nutsedges

Additional Modified Stems Found on Plants

- Cladode
- Corms
- Bulbs
- Tendrils
- Thorns
- Bulbil



Stems & Modified Stems



● Tillers

- A type of stem that grows **vertically** in close proximity to the existing plant.
- Tillers are referred to as “**primary lateral stems**”
- Grasses that produce tillers only are referred to as “**bunch-type**” grasses.

Bunch-Type Grasses (Tillers Only)

- Bunch-type grasses lack the ability to spread *laterally*.
- Seeding is required if thinning occurs.
- Examples:
 - Tall fescue
 - Perennial ryegrass
 - Annual ryegrass

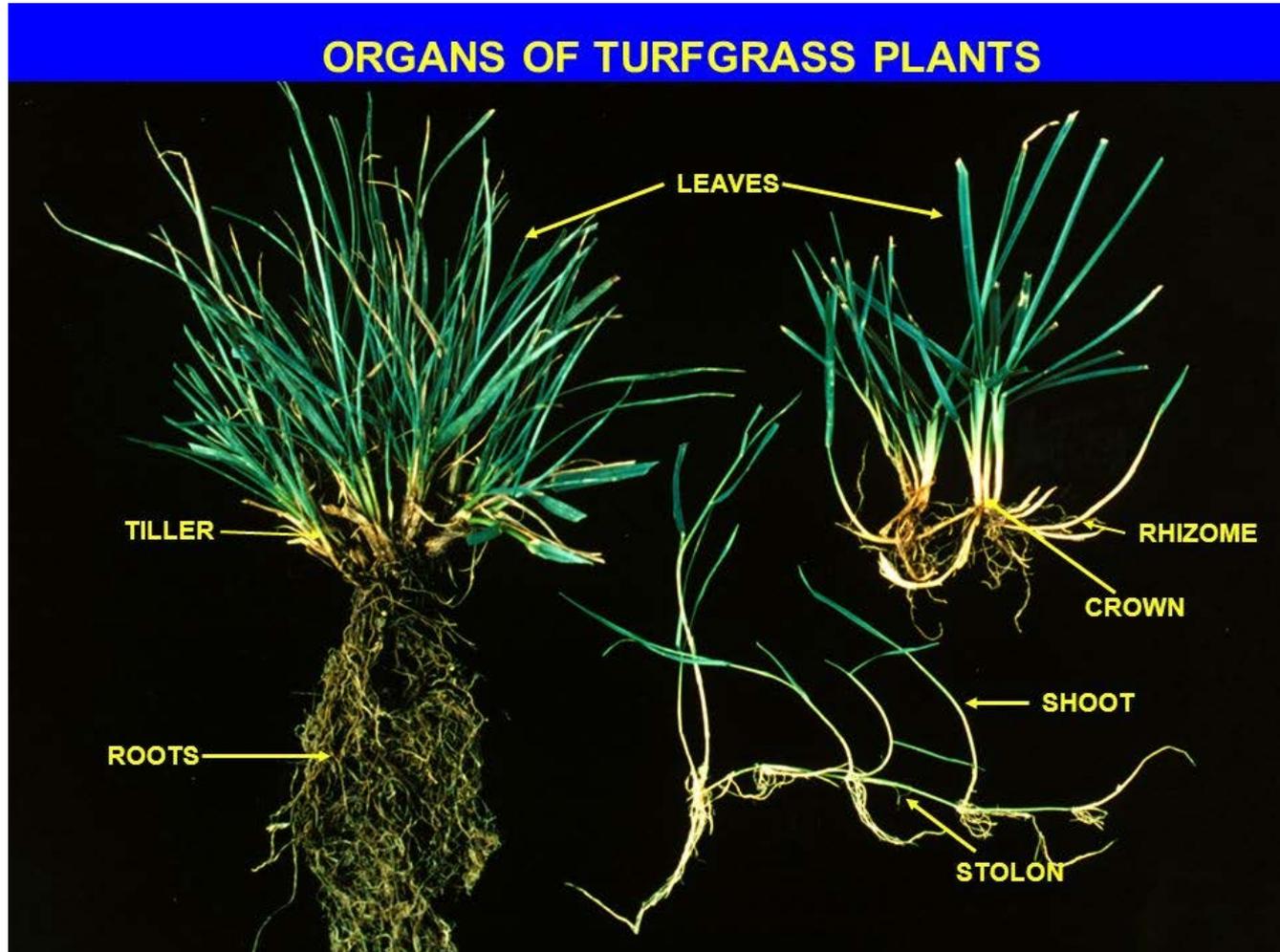


Stems & Modified Stems

- **Stolons:** “A horizontal branch from the base of a plant that produces new plants from buds at its tip or nodes.” Commonly referred to as “runners”.
- **Rhizomes:** “A somewhat elongated usually horizontal subterranean plant stem that is often thickened by deposits of reserve food material, produces shoots above and roots below, and is distinguished from a true root in possessing buds, nodes, and usually scalelike leaves.”



Lateral Stems



Primary Turfgrass Growth Habits

- **Bunch-type**

- Tall fescue, Perennial ryegrass, Annual ryegrass, and Annual bluegrass

- **Stoloniferous**

- Creeping Bentgrass, Centipedegrass, Buffalograss, and St. Augustinegrass

- **Rhizomatous**

- Kentucky bluegrass, Bahiagrass, and Johnsongrass

- **Stoloniferous and Rhizomatous**

- Bermudagrass and Zoysiagrass

Lateral Growth and Asexual Propagation

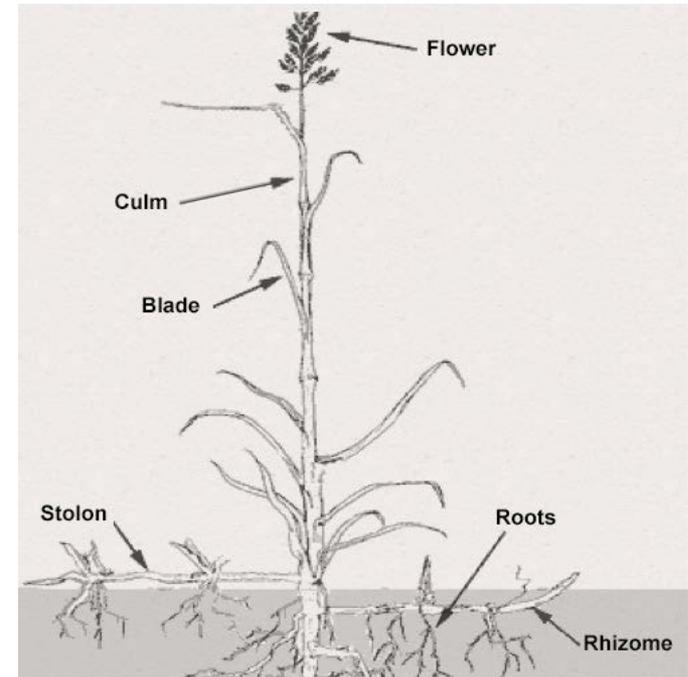
- **Stolons and rhizomes allow some turfgrasses to spread laterally, expanding across an area with efficiency.**
- This can be good for recovery from wear
- This allows for alternative vegetative propagation methods including **sprigging and plugging.**



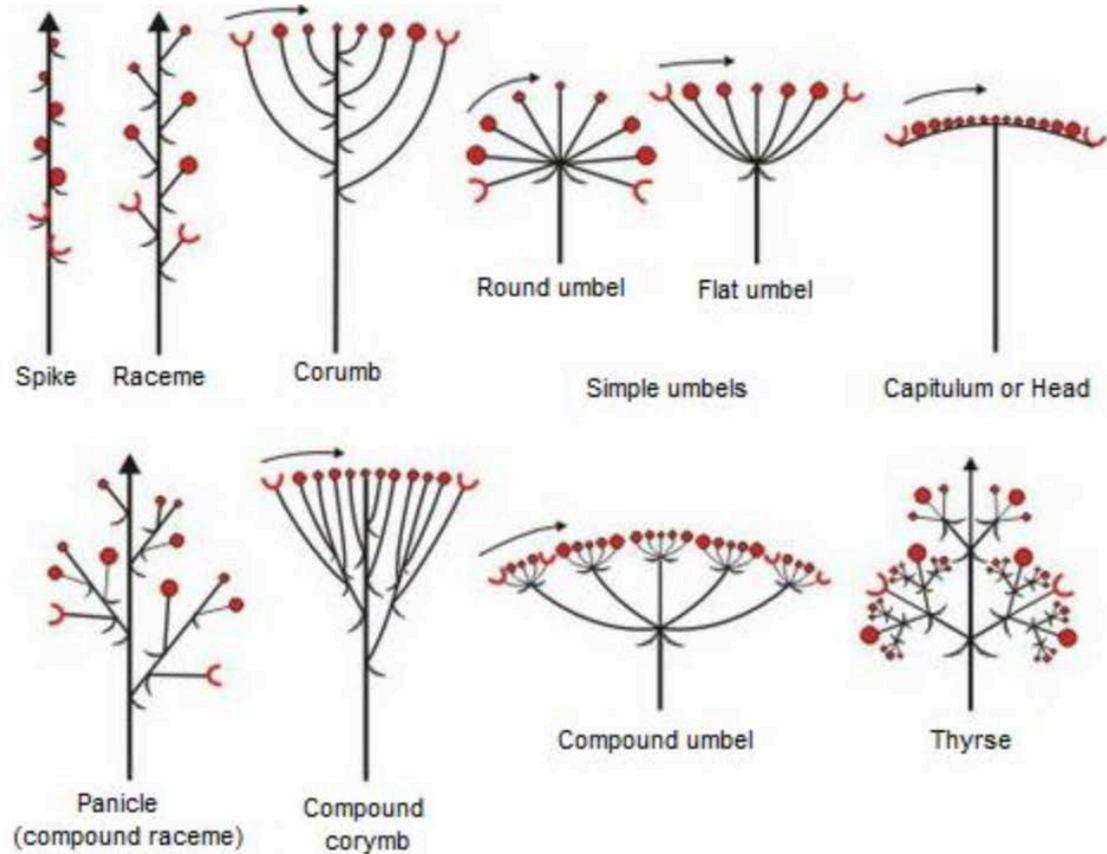
Turfgrass Morphology

Culms and Inflorescences

- **Culm:** The flowering stem of the grass plant which produces the seedhead.
- Many turfgrasses have the ability to produce seed on seedheads known as **inflorescences**.
- **Inflorescences can also be very helpful in proper identification of a turfgrass species.**



Inflorescences



Examples of Seedheads

Bermudagrass



St. Augustinegrass



Centipedegrass



Bahiagrass

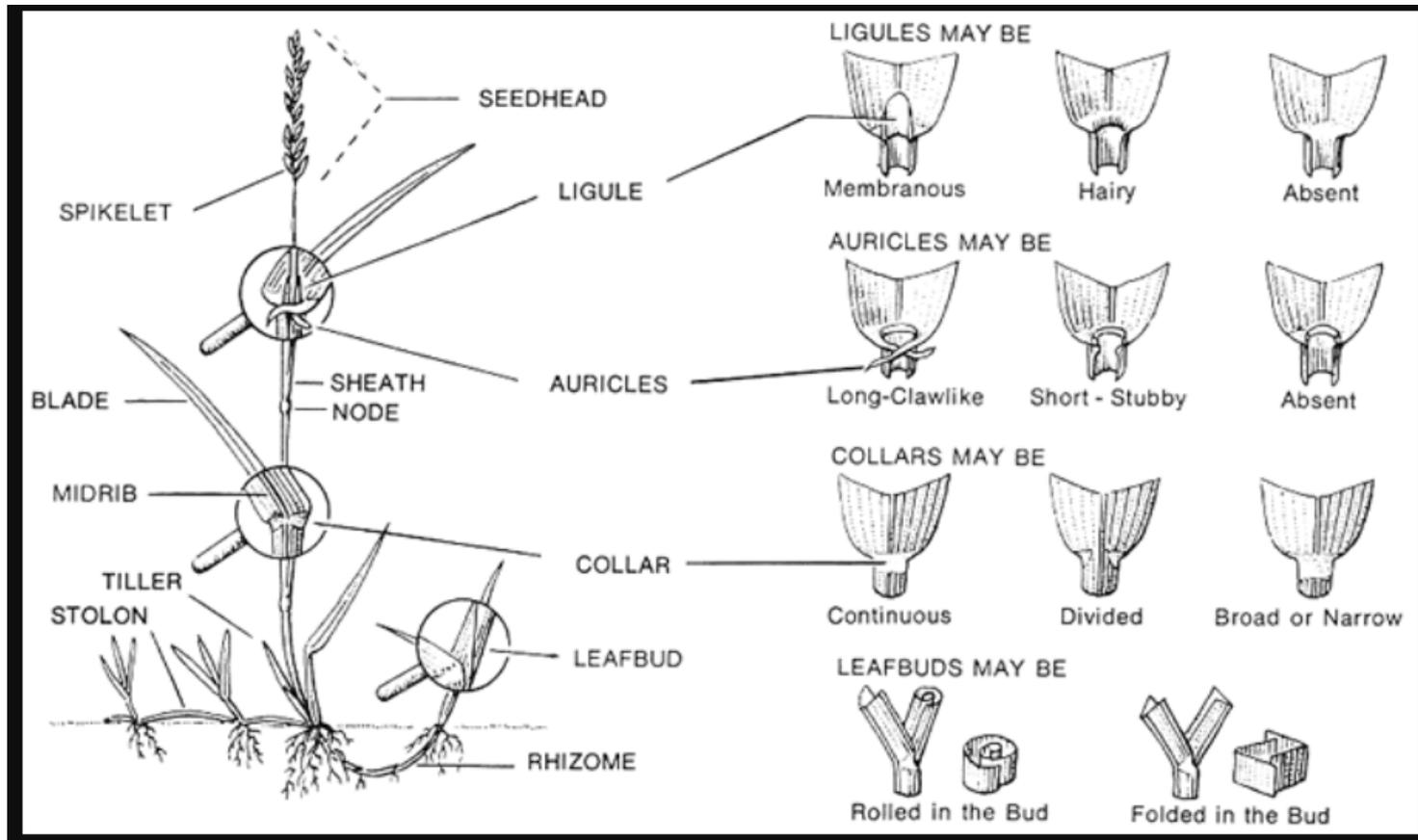


Johnsongrass

Turfgrass Key for Vegetative Identification

- It is also important to know the morphological characteristics of a turfgrass plant in order for this key to be accurate and effective.
- The characteristics to become familiar with are:
 - Vernation
 - Ligule
 - Auricle
 - Sheath
 - Collar

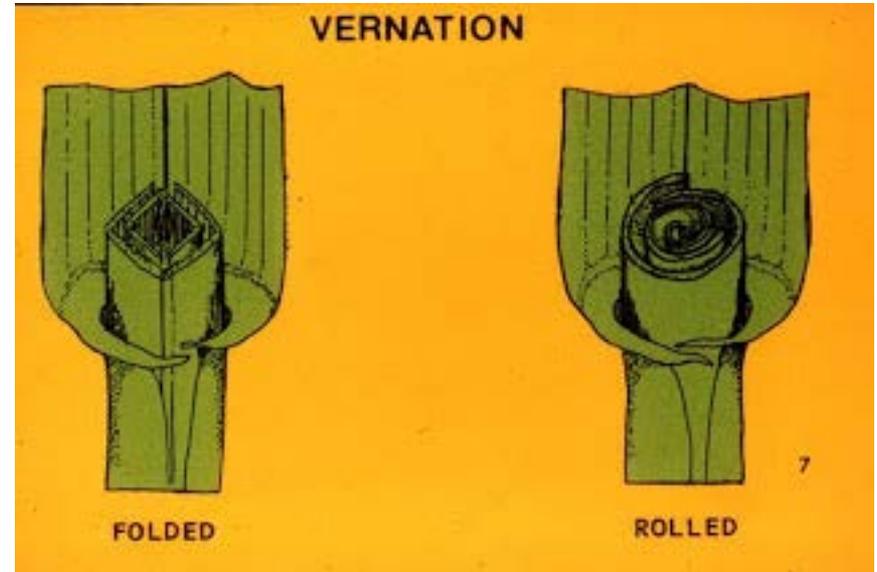
Vegetative ID of Grassy Plants



Turfgrass Morphology

Vernation

- Vernation refers to the arrangement of the leaves in the budleaf (youngest leaf) and the surrounding sheath.
- Vernation can be **rolled or folded**.



Turfgrass Morphology

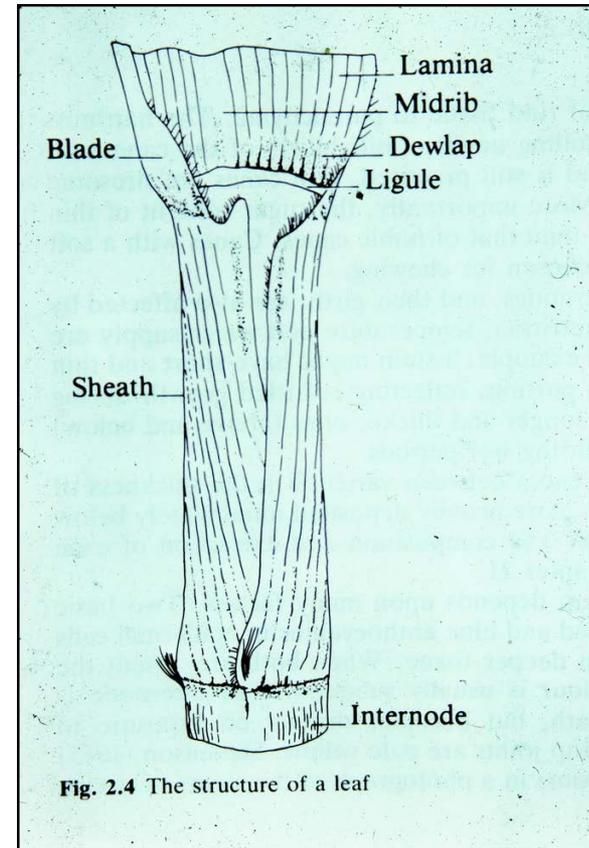
Leaves

- Leaves originate from the growing point located at the top of the crown and are the most visible portion of the turfgrass plant.
- They are also the major site of food production because this is where photosynthesis takes place.

Turfgrass Morphology

Leaves

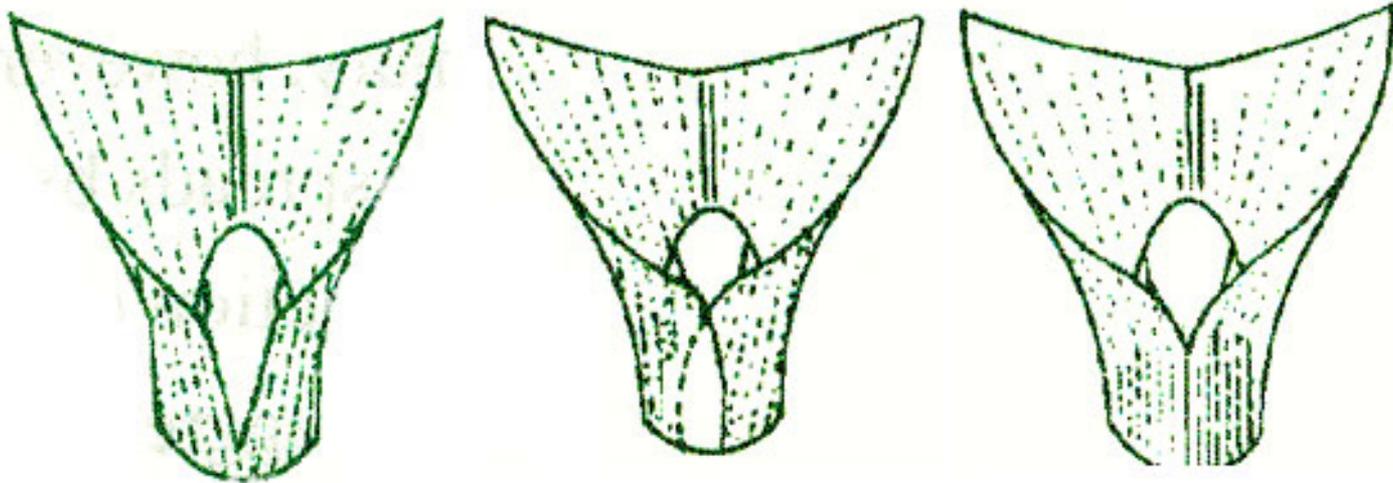
- The highest and oldest portion of the leaf is the blade (**lamina**).
- The lowest portion of the leaf is the **sheath** which holds the blade in place.



Turfgrass Morphology

Sheath

- The sheath is the basal portion of the grass leaf between the crown and the blade.
- It can be split, split with overlapping margins, or closed.



Split **Split with overlapping** **Closed**
margins

Turfgrass Morphology

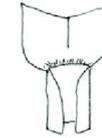
Ligules

The ligule of a grass plant is located directly above the collar on the opposite side of the leaf blade.

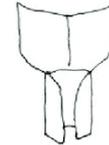
Ligule types



Membranous



Fringe of hairs



Absent

Ligule shapes



Acute



Obtuse



Truncate



Emarginate

Ligule margins



Entire



Notched



Lacerate



Ciliate

Ligules



Fringe of Hairs



Absent



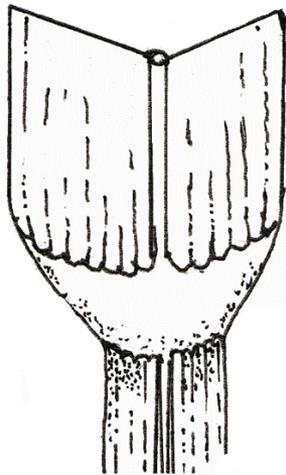
Membraneous

Turfgrass Morphology

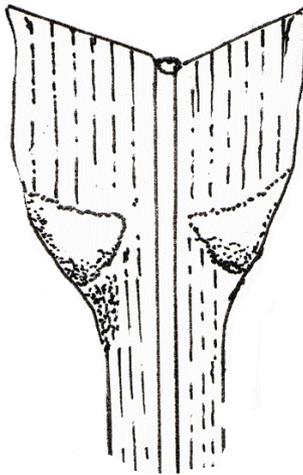
Collar

The collar is located where the blade and the sheath meet.

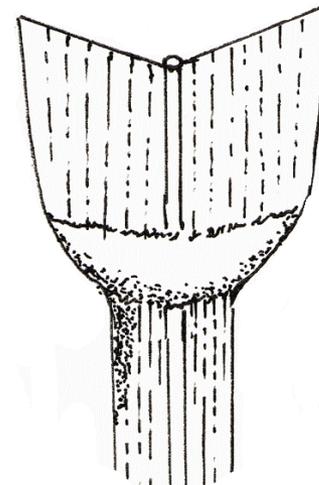
Collar: Region of junction between blade and leaf sheath of grasses.



Broad



Divided

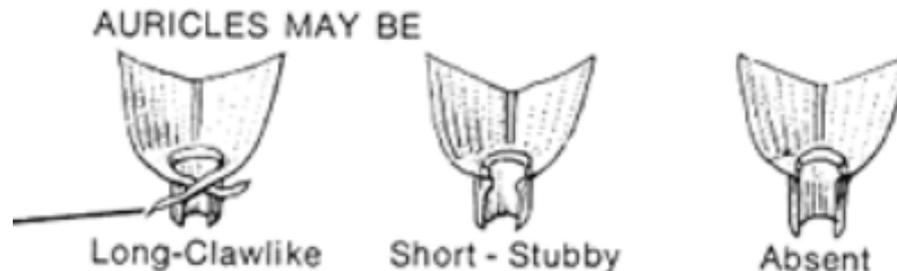


Narrow

Turfgrass Morphology

Auricles

- Auricles, if present, extend away from the blade around the sheath.
- Auricles can be absent, rudimentary, or claw-like.
 - Absent means there are no auricles present
 - Rudimentary auricles wrap partially around the sheath
 - Clawlike auricles extend completely around the sheath



Auricles



**Long & Claw-like or
Clasping**



Short



Absent

Morphology Recap

Takeaway Points

- It is important to have a basic understanding of:
- Turfgrass Growth Habits
 - Bunch-type, Rhizomatous, Stoloniferous
- Seedheads/Inflorescences
- Turfgrass Plant Parts
 - Ligule, Collar, Auricle
- Each of these will play a role in proper turfgrass identification and subsequent management

Turfgrass ID & Selection



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True or False

- Most commercially-available turfgrass species found in the U.S. are native to North America.

False

- Most turfgrasses used in the United States are native to other continents.
 - Europe (Bluegrasses, fescues, ryegrasses, and bentgrasses)
 - Asia (Zoysiagrasses)
 - Africa (Bermudagrasses)
 - West Indies (St. Augustinegrass)

Native Species?

- What is the best known turfgrass species used that is native to the United States?

Native Species

- Buffalograss (*Buchloe dactyloides*)



Grasses in Texas

- Over 700 species of grass grown in the state of Texas
 - Most are used as forages and biofuel crops
- 14 primary species used as turfgrasses in Texas
 - 7 primary warm-season species
 - 7 primary cool-season species

Turfgrass Selection: Not all grasses are Created Equal

1. Geographical Characteristics
2. Site Characteristics
3. Expectations and Use
4. Management Capabilities



1. Geographical Characteristics

- Annual Rainfall
- Average Humidity
- Seasonal Temperatures and Daily Fluctuations
- Soil Classification and General Properties
- Topography
- Wind
- Water Availability
- Water Quality
- Municipal Ordinances

2. Site Characteristics

- Shade
- Drainage
- Site-specific Soil Properties
 - pH
 - Texture
 - Structure
 - Nutrient Availability
- History
 - Diseases
 - Weeds
 - Insects
- Irrigation
- Water Quality

3. Use & Expectations



4. Management Capabilities

- Irrigation
 - Equipment
 - Regulations
- Rainwater Catchment
- Tree-trimming, Shade-monitoring
- Mowing frequency
- Fertilizer program
- Pest Management Program
- Self or Service?
- Type of Mower

Warm vs. Cool-Season Grasses

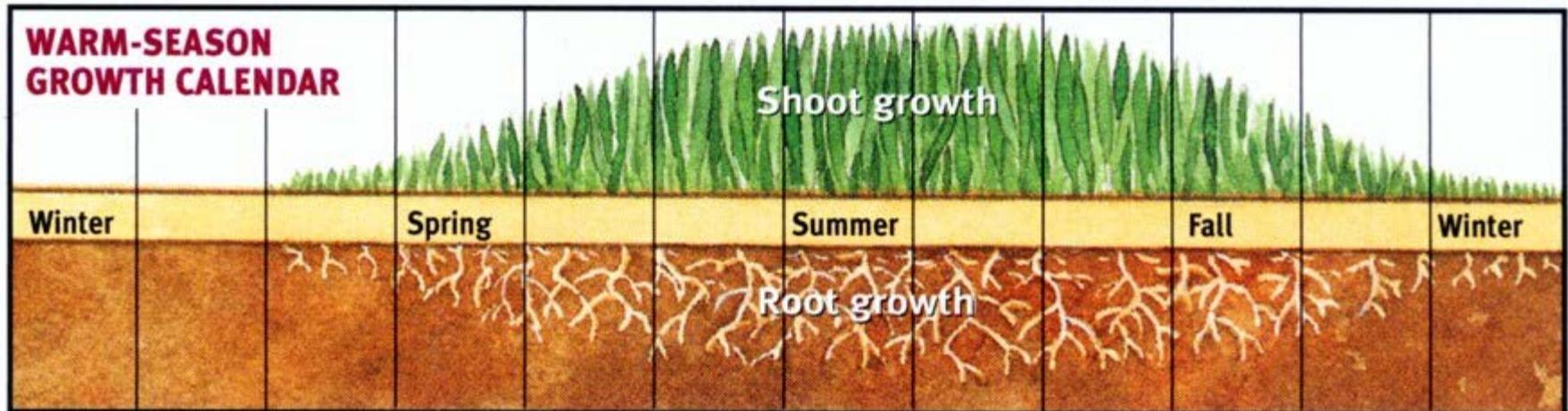
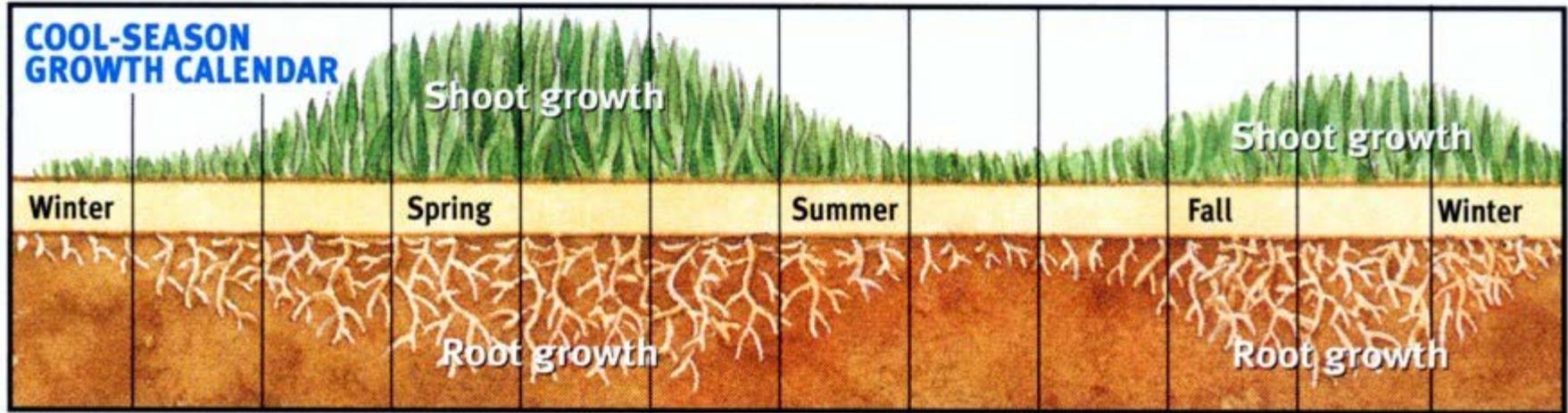
Warm-season Characteristics*	Cool-season Characteristics
High water-use efficiency	Low water-use efficiency
High nitrogen-use efficiency	Low nitrogen-use efficiency
Ideal temperature range of 80-95 F	Ideal temperature range of 60-75 F
Drought hardiness	High disease incidence
Good stress recovery (rhizomatous/stoloniferous growth habit)	Poor stress recovery (rhizomatous/stoloniferous growth habit)

*Warm-season species are *well adapted* for Texas environments

Warm- and Cool-Season Species

Warm-season Species	Cool-season Species
Bahiagrass	Annual ryegrass
Bermudagrass	Creeping bentgrass
Buffalograss	Fine fescue
Centipedegrass	Kentucky bluegrass
Seashore Paspalum	Perennial ryegrass
St. Augustinegrass	Tall fescue
Zoysiagrass	Texas Bluegrass

Cool-Season vs. Warm-Season Grasses



Cool-Season vs. Warm-Season



<http://gardenclub.homedepot.com/>

Proper Turfgrass Selection

Warm-season Species	Strengths	Weaknesses
Bahiagrass	Rapid growth, low N use, drought	Shade, salts, mowing frequency, lack of density
Bermudagrass	Heat, drought, traffic, disease	Shade
Buffalograss	Drought, low input	Disease, moisture, traffic, fertilization, salts
Centipedegrass	Low input	Traffic, salts, high pH, shade
Seashore Paspalum	Salts, traffic, shade	Cold, disease
St. Augustinegrass	Shade	Traffic, cold, disease
Zoysiagrass	Heat, drought, shade, moderate traffic, cold, low input (Z. matrella spp.)	Thatch, slow establishment/recovery rate

Bahiagrass



Bahiagrass

- Scientific name: *Paspalum notatum*
- Vegetative characteristics:
 - Vernation: rolled, but may appear folded
 - Ligule: membranous, dense white hairs on back
 - Auricles: absent
 - Collar: broad
 - Sheath: flattened, sharply creased
 - Blade: sparsely hairy
 - Rhizomes: yes, strong woody rhizomes
 - Stolons: none

Bahiagrass

V-shaped seedhead



Strong woody rhizomes



Bahiagrass

Description

- Bahiagrass is a coarse-textured turfgrass that spreads by rhizomes.
- It is typically considered a weed in most turf settings for the following reasons:
 - Unsightly seedhead
 - Open canopy
 - Difficult to mow
- However, it can be used as a low maintenance utility turf.

Proper Turfgrass Selection

Warm-season Species	Strengths	Weaknesses
Bahiagrass	Rapid growth, low N use, drought	Shade, salts, mowing frequency, lack of density
Bermudagrass	Heat, drought, traffic, disease	Shade
Buffalograss	Drought, low input	Disease, moisture, traffic, fertilization, salts
Centipedegrass	Low input	Traffic, salts, high pH, shade
Seashore Paspalum	Salts, traffic, shade	Cold, disease
St. Augustinegrass	Shade	Traffic, cold, disease
Zoysiagrass	Heat, drought, shade, moderate traffic, cold, low input (Z. matrella spp.)	Thatch, slow establishment/recovery rate

Bermudagrass

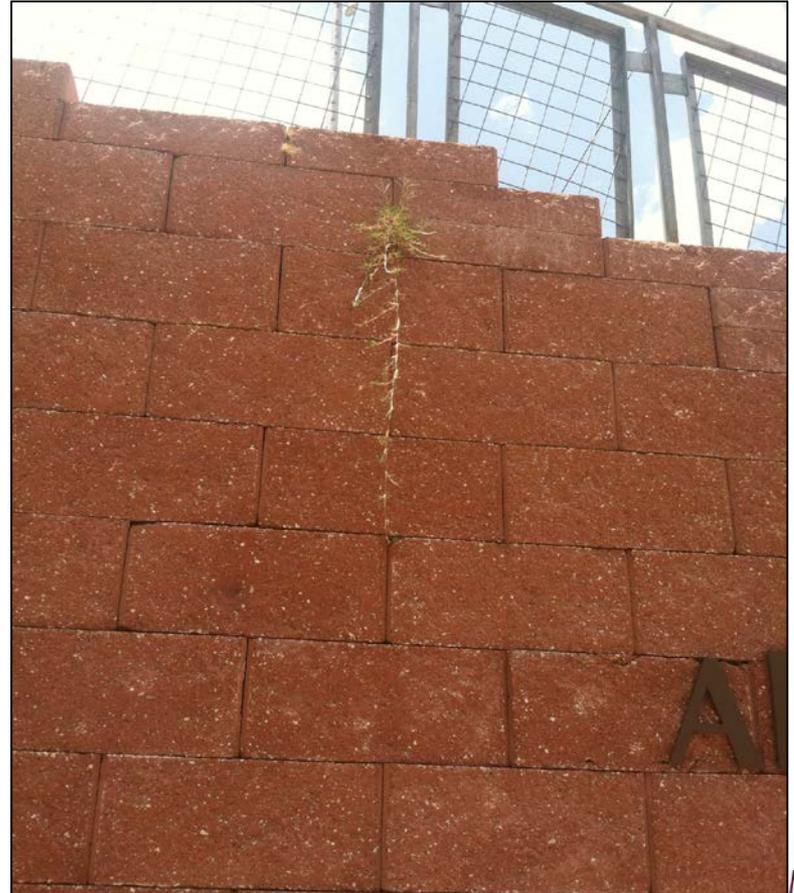


Bermudagrass

Seedhead



Stolons



Bermudagrass

- Scientific name: *Cynodon dactylon*
- Vegetative characteristics:
 - Vernation: folded
 - Ligule: fringe of hairs 1-3 mm long
 - Auricles: absent
 - Collar: continuous, narrow, not hairy, may be hairy on edges
 - Sheath: split with overlapping edges
 - Blade: tapers to point, sparsely hairy
 - Rhizomes: yes, stout
 - Stolons: yes, stout

Bermudagrass



Proper Turfgrass Selection

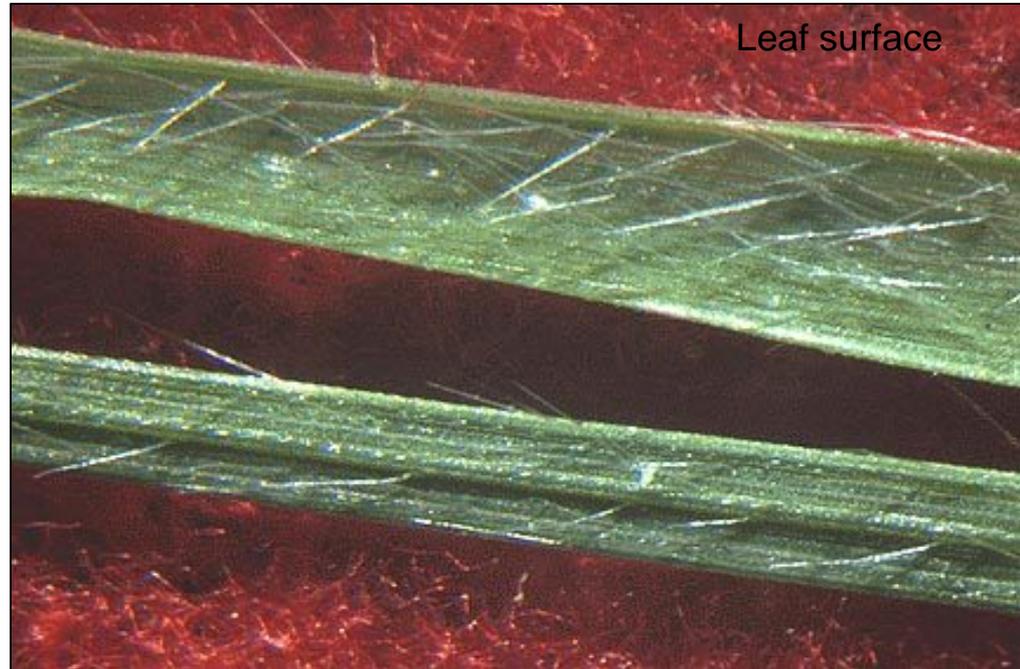
Warm-season Species	Strengths	Weaknesses
Bahiagrass	Rapid growth, low N use, drought	Shade, salts, mowing frequency, lack of density
Bermudagrass	Heat, drought, traffic, disease	Shade
Buffalograss	Drought, low input	Disease, moisture, traffic, fertilization, salts
Centipedegrass	Low input	Traffic, salts, high pH, shade
Seashore Paspalum	Salts, traffic, shade	Cold, disease
St. Augustinegrass	Shade	Traffic, cold, disease
Zoysiagrass	Heat, drought, shade, moderate traffic, cold, low input (Z. matrella spp.)	Thatch, slow establishment/recovery rate

Buffalograss

Sheath



Leaf surface



Buffalograss Description

- Scientific name: *Buchloe dactyloides*
- Vegetative characteristics:
 - Vernation: rolled
 - Ligule: fringe of hairs 0.5-1 mm long
 - Auricles: absent
 - Collar: continuous, broad, hairy
 - Sheath: round, open
 - Blade: flat, 1-3 mm wide
 - Rhizomes: none
 - Stolons: yes, stout

Buffalograss



Proper Turfgrass Selection

Warm-season Species	Strengths	Weaknesses
Bahiagrass	Rapid growth, low N use, drought	Shade, salts, mowing frequency, lack of density
Bermudagrass	Heat, drought, traffic, disease	Shade
Buffalograss	Drought, low input	Disease, moisture, traffic, fertilization, salts
Centipedegrass	Low input	Traffic, salts, high pH, shade
Seashore Paspalum	Salts, traffic, shade	Cold, disease
St. Augustinegrass	Shade	Traffic, cold, disease
Zoysiagrass	Heat, drought, shade, moderate traffic, cold, low input (Z. matrella spp.)	Thatch, slow establishment/recovery rate

Centipedegrass



Centipedegrass

- Scientific name: *Eremochloa ophiuroides*
- Vegetative characteristics:
 - Vernation: folded
 - Ligule: short, membranous with fine hairs
 - Auricles: absent
 - Collar: continuous, broad, hairs on lower edge
 - Sheath: edges overlapping, grayish hairs
 - Blade: flattened, short, sharply creased, hairs on edge at base
 - Rhizomes: none
 - Stolons: yes, stout

Centipedegrass



Centipedegrass



Folded vernation

Proper Turfgrass Selection

Warm-season Species	Strengths	Weaknesses
Bahiagrass	Rapid growth, low N use, drought	Shade, salts, mowing frequency, lack of density
Bermudagrass	Heat, drought, traffic, disease	Shade
Buffalograss	Drought, low input	Disease, moisture, traffic, fertilization, salts
Centipedegrass	Low input	Traffic, salts, high pH, shade
Seashore Paspalum	Salts, traffic, shade	Cold, disease
St. Augustinegrass	Shade	Traffic, cold, disease
Zoysiagrass	Heat, drought, shade, moderate traffic, cold, low input (Z. matrella spp.)	Thatch, slow establishment/recovery rate

St. Augustinegrass



St. Augustinegrass

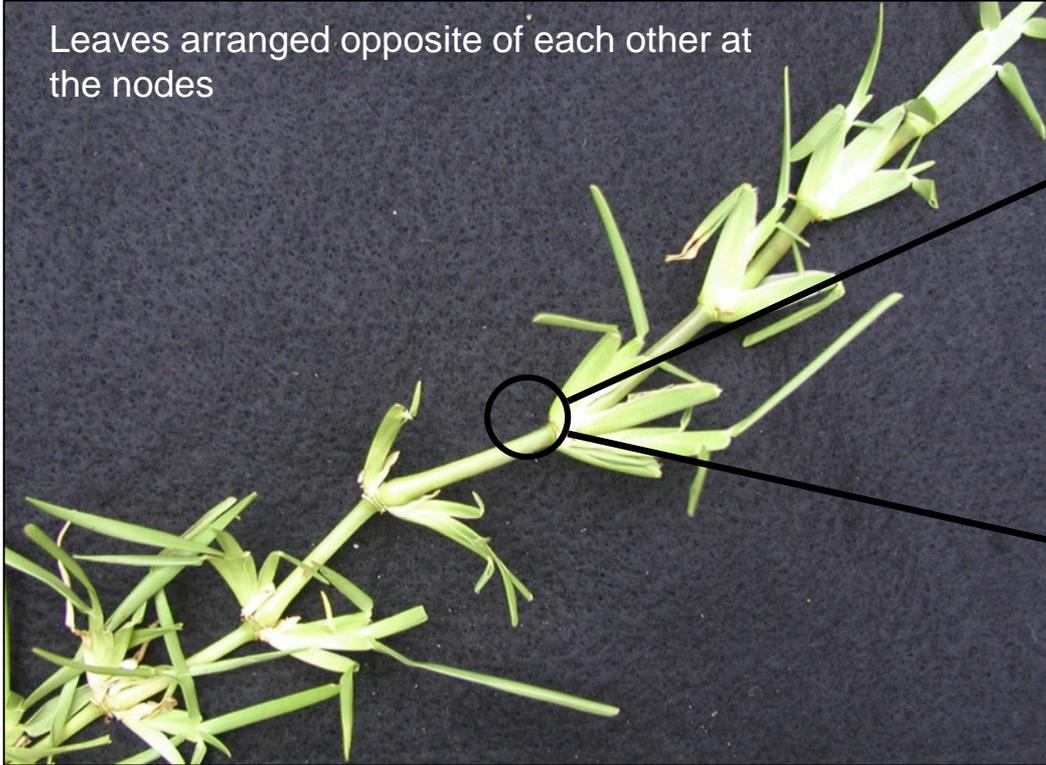
- Scientific name: *Stenotaphrum secundatum*
- Vegetative characteristics:
 - Vernation: folded
 - Ligule: short, fringe of hairs 0.3 mm long
 - Auricles: absent
 - Collar: continuous, broad, not hairy
 - Sheath: flattened, sharply creased
 - Blade: not hairy, tip is blunt
 - Rhizomes: none
 - Stolons: yes, stout

St. Augustinegrass



St. Augustinegrass

Leaves arranged opposite of each other at the nodes



Seedhead



Proper Turfgrass Selection

Warm-season Species	Strengths	Weaknesses
Bahiagrass	Rapid growth, low N use, drought	Shade, salts, mowing frequency, lack of density
Bermudagrass	Heat, drought, traffic, disease	Shade
Buffalograss	Drought, low input	Disease, moisture, traffic, fertilization, salts
Centipedegrass	Low input	Traffic, salts, high pH, shade
Seashore Paspalum	Salts, traffic, shade	Cold, disease
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Zoysiagrass	Heat, drought, shade, moderate traffic, cold, low input (Z. matrella spp.)	Thatch, slow establishment/recovery rate

Zoysiagrass



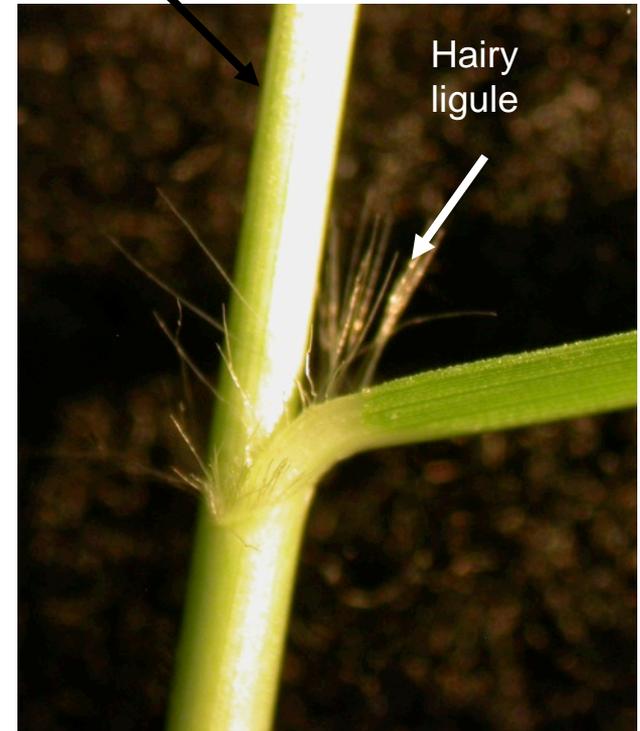
Zoysiagrass

- Scientific name: *Zoysia japonica*
- Vegetative characteristics:
 - Vernation: rolled
 - Ligule: fringe of hairs 0.2 mm long
 - Auricles: absent
 - Collar: continuous, broad, edges hairy
 - Sheath: split with overlapping edges
 - Blade: hairs standing up on blade
 - Rhizomes: yes
 - Stolons: yes, stout

Zoysiagrass



Rolled vernation



Zoysiagrass

Description

- There are three major species of Zoysiagrass that are suitable for turf. They are:
 - Japanese lawngrass (*Zoysia japonica*)
 - Mascarenegrass (*Zoysia tenuifolia*)
 - Manilagrass (*Zoysia matrella*)
- There are also several popular interspecific hybrids available for use
- For example, *Z. japonica* x *Z. tenuifolia*

Zoysiagrass species

- ◎ *Zoysia japonica*
 - ◎ Coarse leaf texture
 - ◎ Superior cold tolerance
- ◎ *Zoysia matrella*
 - ◎ Fine leaf texture
 - ◎ Low input
 - ◎ Not as cold tolerant
- ◎ Interspecific crosses
 - ◎ *Z. japonica* x *Z. matrella*

Z. Matrella species



Z. matrella species



Z. japonica species



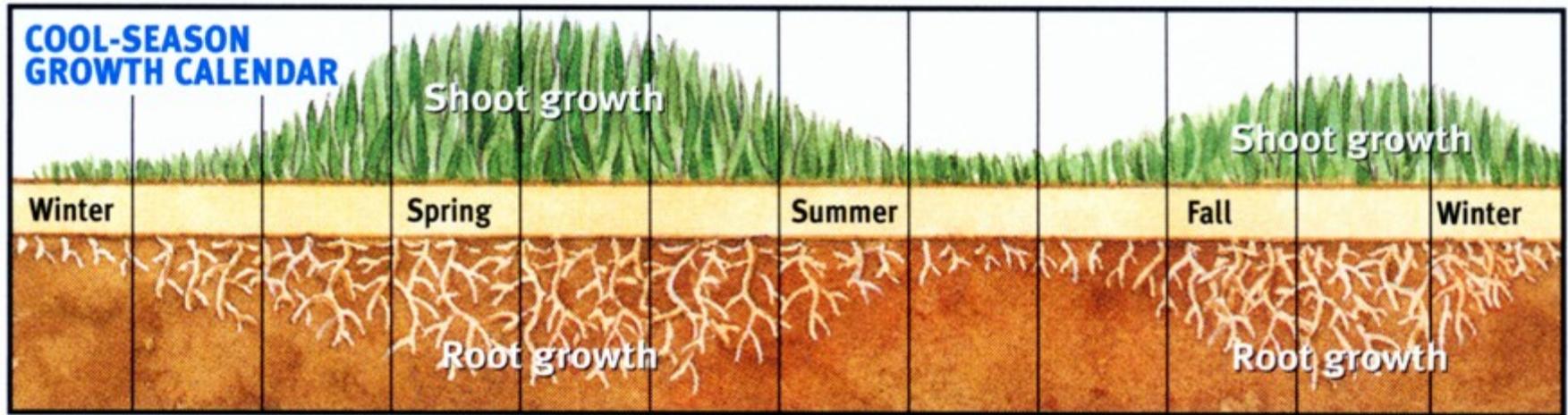
Z. japonica species



Cool-Season Grasses

- This section will cover the adaptation, use, growth habit, and vegetative characteristics of cool-season grasses found in Texas.
- These include:
 - Tall fescue
 - Fine fescue
 - Kentucky bluegrass
 - Texas Bluegrass
 - Perennial ryegrass
 - Annual ryegrass
 - Creeping bentgrass

Cool-Season Grass Growth Calendar



Cool-Season Grasses

- Unlike warm-season grasses, cool-season grasses are often established by seed and species are sometimes blended or mixed rather than planted alone.
 - Blend: Combination of 2 or more cultivars of the same species
 - Ex: Kentucky 31, Rebel, and Coronado
 - Mixture: Combination of 2 or more species
 - Ex: Tall fescue, Kentucky bluegrass, and fine fescue

Perennial ryegrass



Perennial ryegrass

- Scientific name: *Lolium perenne*
- Vegetative characteristics:
 - Vernation: folded
 - Ligule: membranous, may be toothed near top
 - Auricles: small
 - Collar: divided by midrib, not hairy, distinct
 - Sheath: usually flattened, not hairy
 - Blade: bright green, ridged upper surface, glossy lower surface
 - Rhizomes: none
 - Stolons: none

Perennial ryegrass

Description

- Perennial ryegrass is a bunch-type grass that is established easily by seed and germinates quickly.
- Texture, color, and density are very similar to Kentucky bluegrass.
- Perennial ryegrass has a much finer texture and darker color than annual ryegrass.

Annual ryegrass



Annual ryegrass

- Scientific name: *Lolium multiflorum*
- Vegetative characteristics:
 - Vernation: rolled
 - Ligule: membranous, blunt
 - Auricles: claw-like
 - Collar: continuous, not hairy, distinct
 - Sheath: round, not hairy, split with overlapping margins
 - Blade: bright green, dull upper surface, glossy lower surface
 - Rhizomes: none
 - Stolons: none

Annual ryegrass

Description

- Annual ryegrass is also called common, Italian, or domestic ryegrass.
- It is fast growing, has very poor quality, and is coarse in texture.
- It does not persist for more than one year. (dies when temperatures exceed 85F)

Tall fescue



Tall Fescue

- Scientific name: *Schedonorus arundinaceus*
- Vegetative characteristics:
 - Vernation: rolled
 - Ligule: membranous
 - Auricles: small
 - Collar: divided, broad, may have hairs
 - Sheath: split
 - Blade: deeply ridged, prominent midrib
 - Rhizomes: occasional, but short
 - Stolons: none

Tall fescue



Fine fescue



EXTENSION

Fine fescues

- Scientific name: *Festuca spp.*
- Vegetative characteristics:
 - Vernation: folded
 - Ligule: membranous
 - Auricles: absent
 - Collar: present, but indistinct
 - Sheath: slightly rough, not compressed
 - Blade: very narrow (<1/16 inch), slightly folded
 - Rhizomes: none (except Creeping Red)
 - Stolons: none

Kentucky bluegrass

- Scientific name: *Poa pratensis*
- Vegetative characteristics:
 - Vernation: folded
 - Ligule: membranous, very short
 - Auricles: absent
 - Collar: slightly divided, broad, may have hairs
 - Sheath: flattened, not hairy
 - Blade: boat-shaped tip. Two distinct “light lines”, one on each side of midrib when held up to light.
 - Rhizomes: yes, aggressive
 - Stolons: none

Creeping bentgrass



Creeping bentgrass

- Scientific name: *Agrostis stolonifera*
- Vegetative characteristics:
 - Vernation: rolled
 - Ligule: membranous, blunt
 - Auricles: absent
 - Collar: distinct, usually slanted with unequal sides
 - Sheath: round, smooth, split
 - Blade: flat, slightly creased on lower surface
 - Rhizomes: none
 - Stolons: yes, slender

Creeping bentgrass

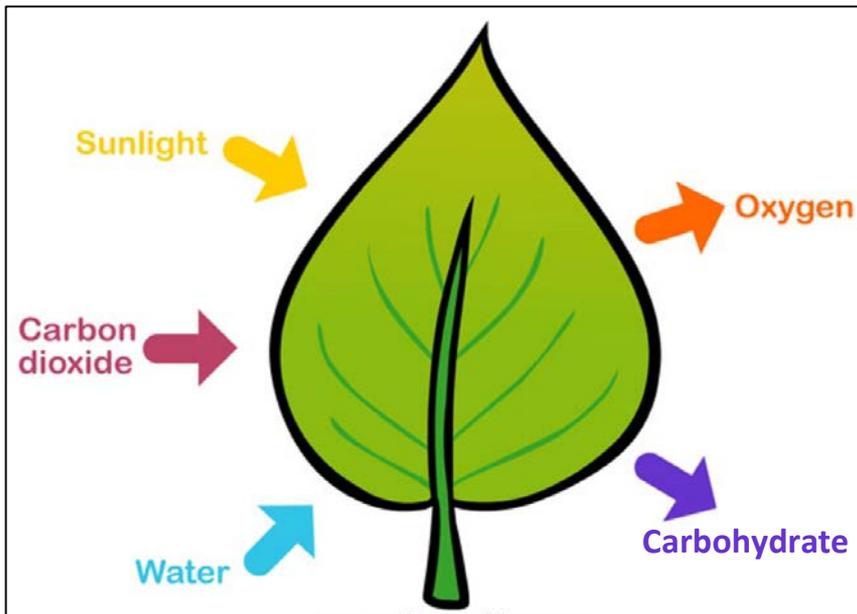
Description

- Creeping bentgrass is a fine-textured species that spreads by stolons.
- It is very tolerant of cold temperatures and close mowing.
- It also recovers well from injury due to its aggressive stolons.
- It is prone to injury from drought, extreme heat, excessive traffic and disease.

Selecting for Key Characteristics

- ◉ Shade
- ◉ Drought
- ◉ Traffic
- ◉ Pest-tolerance

Signs of Excess Shade



- Thinning of the turf canopy
- Elongation (lengthening) of leaves, reduced leaf width, absence of photosynthetic tissue
- Encroachment of weeds
- Eventual death if light is not sufficient for survival
- Increased disease incidence

Bermudagrass is not a fan



Zoysia under filtered shade



But the problem with zoysiagrass is...



St. Augustinegrass



Gardenality.com



Washington-on-the-Brazos

But even St. Augustine needs SOME light



Turfgrass Selection & Use

Warm-season species are typically much better suited for Texas environments

Drought Tolerance	Species
High	Bermudagrass, Buffalograss
	Zoysiagrass (<i>Z. japonica</i>)
	Bahiagrass
	St. Augustinegrass
	Zoysiagrass (<i>Z. matrella</i>)
	Low



Un-irrigated Tifway Bermudagrass
College Station, TX

Summer Dormancy

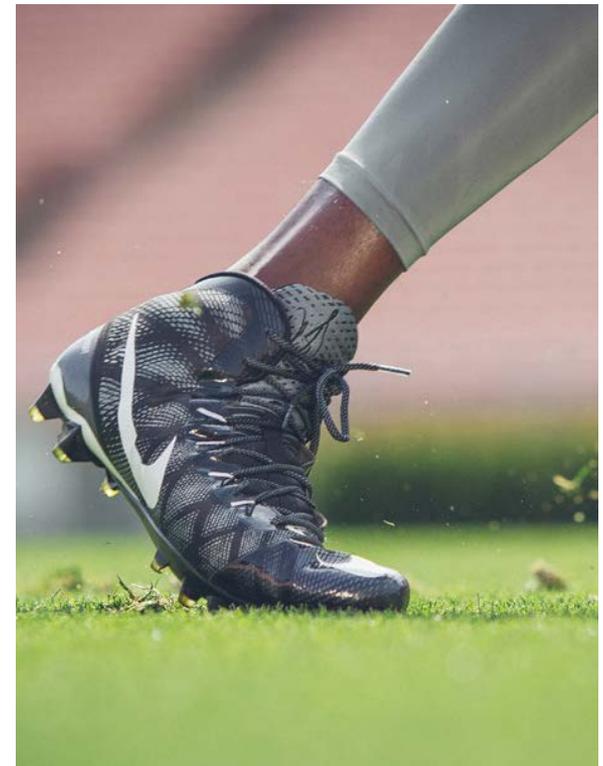
August 2012

November 2012

Turfgrass Selection and Use

Intended use is an important consideration

Traffic Tolerance	Species
High	Zoysiagrass*
↑	Bermudagrass
	Bahiagrass
	St. Augustinegrass
Low	Centipedegrass



TURFGRASS SELECTION & USE



Excessive traffic, compaction, poor soil conditions

Native Grass Seed Blends

- Mixtures of natives such as buffalograss, curly mesquite, and blue grama, etc.
- Reported to require less mowing/fertilizer/water
- Shade and salinity can be problems
- Available only as seed – gets expensive.
- Not recommended east of the Brazos River, eastern TX





NTEP

- NTEP: National Turfgrass Evaluation Program
- <https://ntep.org/ntep/>
- Information such as turfgrass quality, color, density, resistance to diseases and insects, tolerance to heat, cold, drought and traffic is collected and summarized by NTEP annually.
- NTEP information is used by individuals and companies in thirty countries.

TABLE 1A.

TURFGRASS QUALITY RATINGS OF BERMU DAGRASS CULTIVARS
GROWN AT SEVENTEEN LOCATIONS IN THE U.S. 1/
2013-17 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 2/

NAME	ENTRY #	AL1	AR1	AZ1	CA3	FL3	GA1	IN1	KS2	KY1	MD1	MO1	MS1	NC1	OK1	TN1	TX2	VA1	MEAN
*TIFTUF (DT-1)	24	7.1	7.2	7.4	6.7	6.3	6.3	7.0	5.5	7.3	6.7	6.3	7.0	6.5	6.1	7.5	7.8	6.2	6.8
*TAHOMA 31 (OKC 1131)	32	5.9	8.0	6.7	5.8	5.7	6.0	7.7	5.5	7.3	7.6	6.9	6.8	5.7	6.2	7.4	7.0	6.5	6.8
JSC 2-21-18-V	12	5.7	7.7	7.0	6.2	6.4	6.5	7.1	5.7	7.3	7.7	6.3	6.9	5.9	5.8	7.3	7.4	6.4	6.7
11-T-510	23	6.6	7.2	7.0	6.4	6.0	5.6	6.4	5.5	7.0	6.6	6.3	6.8	6.1	6.0	7.4	7.7	6.3	6.6
*LATITUDE 36	2	6.1	7.8	6.6	5.9	5.8	5.8	7.8	5.5	7.4	7.4	5.1	6.8	5.8	6.1	7.3	7.1	6.3	6.6
JSC 2-21-1-V	11	4.8	7.5	6.7	5.7	5.5	6.2	7.4	5.6	7.5	7.2	6.1	6.8	5.2	6.1	7.3	7.3	6.4	6.6
OKC 1163	33	5.1	8.6	7.1	6.2	4.7	6.1	7.0	4.9	7.1	6.2	6.2	6.7	4.9	6.0	6.9	7.5	6.9	6.5
OKC 1302	34	5.2	7.0	5.4	5.9	5.8	5.9	7.0	5.7	7.1	7.4	4.2	6.5	5.6	5.9	7.3	7.0	6.3	6.4
*PATRIOT	3	5.3	7.4	5.7	5.3	6.4	5.6	7.1	5.4	7.1	6.6	5.7	6.0	5.7	5.2	7.1	5.1	6.7	6.4
*TIFWAY	1	6.0	7.0	7.5	6.6	6.0	5.6	6.7	5.0	6.7	6.9	3.6	7.0	5.4	5.8	7.3	7.0	5.6	6.3
*RIVIERA	17	4.3	6.4	6.0	5.6	5.8	4.9	6.7	5.0	7.0	6.1	6.0	6.0	4.4	5.5	7.6	5.6	6.7	6.3
*MONACO (JSC 2007-13-S)	14	4.1	6.7	5.5	5.6	5.6	5.0	6.1	5.1	7.1	6.3	6.0	6.1	4.5	5.5	7.5	5.8	6.9	6.3
FAES 1325	25	5.5	6.4	7.2	6.1	6.0	5.4	6.0	4.6	6.3	5.4	4.2	6.4	5.3	5.7	7.9	6.2	5.5	6.3
*ASTRO	35	4.7	6.7	6.3	5.7	5.9	5.5	6.0	5.1	6.8	5.8	5.2	6.5	5.2	5.8	7.2	6.6	6.1	6.2
11-T-251	22	5.6	6.3	6.6	5.9	5.8	5.5	6.5	4.2	7.1	6.1	4.0	6.9	4.7	5.7	7.3	7.1	5.3	6.2
FAES 1326	26	5.6	7.2	6.1	6.5	5.8	5.3	6.2	5.0	6.6	6.1	3.7	6.1	4.2	5.5	7.4	6.9	6.0	6.2
MBG 002	7	4.1	6.1	6.6	5.5	5.7	5.0	6.1	5.0	7.1	4.7	5.4	6.0	4.6	5.6	7.5	5.8	5.9	6.2
JSC 2009-2-S	15	4.2	6.3	5.9	5.2	5.7	4.9	6.0	5.0	6.8	6.1	5.7	6.1	4.3	5.5	7.7	5.3	6.2	6.2
JSC 2009-6-S	16	3.8	5.7	6.0	5.3	5.7	4.5	6.3	5.1	6.9	5.6	6.0	6.2	4.4	5.6	7.4	5.4	6.5	6.2
JSC 2007-8-S	13	3.9	6.1	5.7	5.5	5.8	4.7	6.1	5.1	6.9	5.8	5.8	6.0	3.7	5.5	7.6	5.5	6.5	6.2
FAES 1327	27	5.8	6.5	6.8	5.8	5.9	5.7	6.4	4.6	6.4	5.6	3.4	6.3	5.4	5.7	7.2	7.3	5.3	6.1
OKS 2011-1	9	3.9	6.0	5.6	5.5	5.6	4.8	5.9	4.9	6.8	5.3	5.0	6.1	3.9	5.3	7.5	5.0	5.8	6.0
*CELEBRATION	4	4.5	5.5	6.8	5.4	5.5	5.4	5.5	4.4	6.3	5.6	4.0	6.3	5.0	5.5	7.5	6.0	5.4	6.0
*PRINCESS 77	6	4.5	6.1	6.4	5.8	5.7	4.6	6.6	3.2	6.7	4.0	4.5	5.9	4.6	5.4	7.4	6.4	5.1	6.0
12-TSB-1	20	5.1	5.7	6.7	5.6	5.9	4.6	6.2	2.9	6.6	4.6	4.3	6.1	4.5	5.3	7.3	6.4	4.8	5.9
*YUKON	18	2.8	4.6	5.3	5.3	5.7	4.3	6.7	4.9	6.6	4.1	5.3	5.3	4.1	5.2	7.5	6.0	6.1	5.8
BAR C291	31	3.4	5.8	5.5	5.1	6.0	4.8	5.5	4.7	6.5	4.1	4.8	5.6	4.0	5.3	7.3	5.1	5.7	5.8
OKS 2011-4	10	3.2	5.7	5.4	5.1	5.8	4.9	5.6	4.4	6.8	4.5	4.8	5.7	4.1	5.2	7.5	4.3	5.5	5.8
PST-R6CT	30	2.7	5.5	5.1	5.3	5.4	4.9	6.2	4.6	6.7	3.8	4.4	5.9	3.4	5.1	7.4	6.0	4.7	5.7
PST-R6P0	28	2.5	5.0	5.5	5.3	5.3	5.0	6.1	4.6	6.6	3.7	4.5	5.8	3.9	5.1	7.4	4.2	5.0	5.7
OKS 2009-3	8	3.2	6.0	5.2	5.1	5.2	4.8	5.5	4.2	6.1	4.6	4.5	5.8	3.8	5.1	7.3	4.6	5.3	5.6
MSB 281	21	3.6	3.5	5.7	5.0	5.2	5.1	6.1	3.2	6.3	5.8	3.4	6.7	4.3	4.7	6.9	4.8	5.3	5.6
*NORTH SHORE SLT	19	2.8	5.7	5.6	5.0	5.4	4.6	5.5	4.4	5.6	3.6	4.2	5.4	3.3	5.0	7.5	5.0	4.7	5.6
PST-R6T9S	29	3.0	4.4	5.3	4.9	5.2	4.6	6.3	4.0	5.7	3.9	4.3	5.9	3.6	5.0	7.2	4.4	4.8	5.4
*NUMEX-SAHARA	5	1.9	5.1	4.7	5.0	5.6	4.4	5.5	3.8	5.9	3.8	3.9	5.2	2.9	4.6	7.5	4.0	3.7	5.3
LSD VALUE		1.1	0.9	0.9	0.5	0.6	0.7	0.9	0.6	0.8	1.1	0.9	0.4	0.8	0.3	0.5	1.1	1.0	0.3
C.V. (%)		14.7	9.1	8.8	5.5	6.3	9.6	8.0	8.2	7.5	11.8	12.2	3.9	11.4	3.8	4.4	11.5	10.9	7.5

*/ COMMERCIALLY AVAILABLE IN THE USA IN 2018

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

2/ C.V. (COEFFICIENT OF VARIATION) INDICATES THE PERCENT VARIATION OF THE MEAN IN EACH COLUMN.

TABLE 4A.

MEAN TURFGRASS QUALITY AND OTHER RATINGS OF BERMUDAGRASS CULTIVARS
UNDER DROUGHT STRESS AT COLLEGE STATION, TX 1/
2015-17 DATA

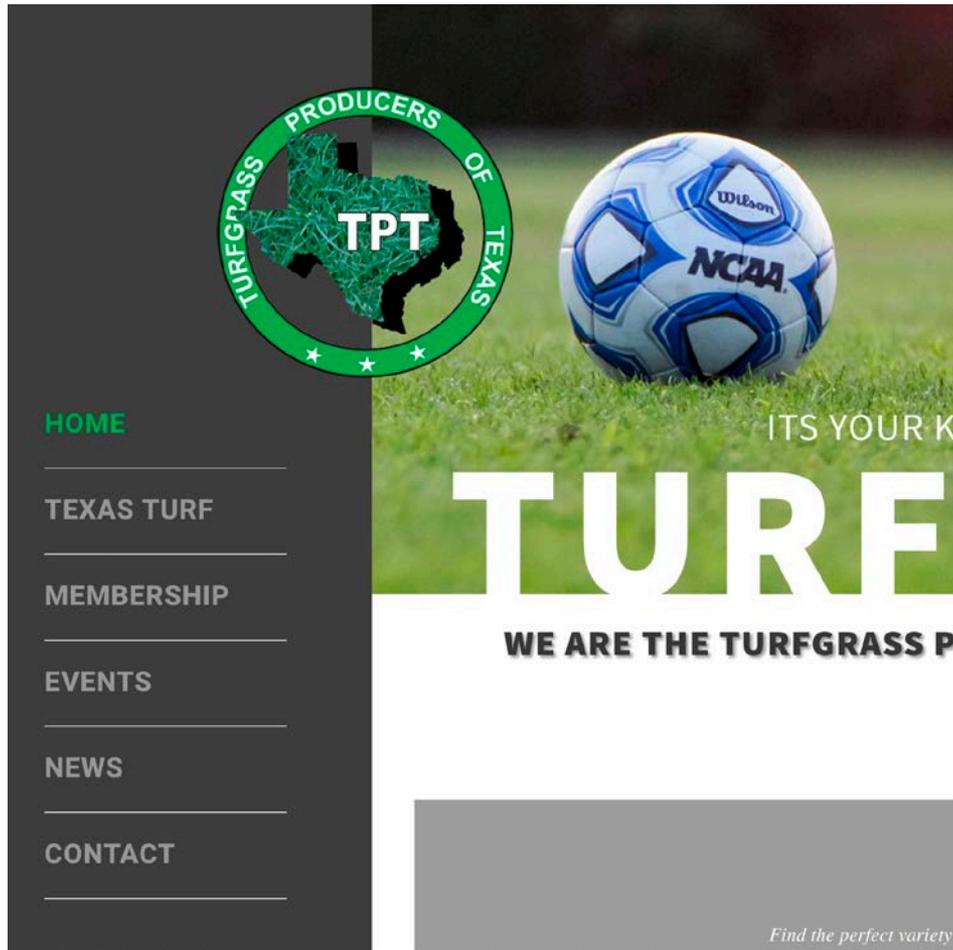
TURFGRASS QUALITY AND OTHER RATINGS 1-9; 9=BEST 2/

NAME	GENETIC COLOR	SPRING GREENUP	LEAF TEXTURE	WINTER COLOR	WINTER	WINTER	SEEDHEAD	APR	MAY	JUN	QUALITY RATINGS					MEAN
					COLOR	NOVEMBER					DECEMBER	JUL	AUG	SEP	OCT	
TIFTUF (DT-1)	7.7	6.8	8.2	4.7	9.0	8.0	9.0	8.0	7.0	7.7	7.7	7.3	7.6	8.0	7.6	
11-T-510	7.2	6.7	7.3	4.3	6.7	5.0	9.0	7.3	6.3	6.8	6.8	7.7	6.3	6.9	6.0	
JSC 2-21-18-V	7.2	6.7	7.7	4.0	8.0	5.3	7.3	7.2	7.2	7.3	7.6	7.2	5.6	6.4	6.0	
TAHOMA 31 (OKC 1131)	7.1	6.2	7.3	3.3	7.0	3.3	9.0	7.0	6.7	6.5	7.2	7.0	5.7	7.0	6.7	
OKC 1163	7.4	7.3	8.8	4.3	6.3	3.3	9.0	7.7	7.5	6.5	6.9	7.6	5.1	6.2	4.7	
FAES 1325	7.0	6.7	6.6	4.3	7.0	4.7	7.3	6.5	6.7	6.7	6.7	6.4	6.3	6.1	6.3	
FAES 1326	7.6	6.2	7.2	4.3	7.0	5.0	8.0	7.2	6.7	7.2	6.9	6.9	5.7	5.6	5.7	
12-TSB-1	6.7	5.5	6.4	3.5	7.0	5.0	6.0	6.0	6.3	6.0	6.2	6.1	6.1	6.4	6.0	
JSC 2-21-1-V	7.0	5.7	7.6	4.0	8.0	6.3	8.7	6.2	6.3	6.5	7.2	7.0	5.0	5.3	6.0	
LATITUDE 36	7.1	6.0	7.3	4.3	7.0	5.7	9.0	6.2	6.3	6.2	6.8	6.8	5.3	5.8	5.7	
OKC 1302	6.8	6.3	6.6	4.2	7.7	6.0	7.7	6.5	6.2	6.5	6.6	6.8	4.9	6.1	5.3	
CELEBRATION	7.1	6.0	6.4	4.2	7.0	4.7	9.0	6.2	5.7	6.0	6.3	6.4	5.7	6.0	6.7	
FAES 1327	7.2	6.0	7.2	4.2	7.0	4.7	9.0	6.7	6.5	6.8	6.7	6.8	5.1	5.4	4.7	
MONACO (JSC 2007-13-S)	6.8	4.8	5.9	3.8	6.3	3.7	6.7	5.7	5.8	6.2	6.1	6.1	6.1	6.0	5.3	
11-T-251	6.9	5.8	6.8	4.3	6.3	2.7	9.0	6.3	5.8	6.0	5.7	6.2	5.2	6.0	6.3	
TIFWAY	7.3	6.0	7.2	4.0	7.3	5.7	9.0	6.3	5.3	6.3	6.6	6.4	5.1	5.8	5.7	
PATRIOT	6.8	6.0	5.9	3.8	5.0	3.0	7.0	5.5	5.3	5.3	6.0	5.9	5.8	5.4	4.7	
ASTRO	5.4	4.8	5.9	3.2	5.7	4.3	8.3	6.2	6.0	6.3	5.7	6.0	4.6	5.4	4.0	
MBG 002	5.8	5.3	5.7	4.0	6.7	4.3	6.0	5.7	5.3	5.8	5.9	5.6	5.2	5.8	5.0	
PRINCESS 77	6.0	5.0	6.3	4.5	6.0	4.7	6.3	5.7	5.3	6.0	5.7	5.7	5.1	5.8	4.0	
JSC 2009-2-S	6.0	4.7	5.4	3.3	6.0	3.3	4.3	5.0	5.3	5.3	5.4	5.8	5.1	5.1	4.0	
JSC 2007-8-S	5.7	4.7	5.4	3.3	5.0	3.0	4.3	4.7	4.8	5.0	5.6	5.4	4.9	5.1	4.3	
PST-R6CT	5.8	4.8	5.4	4.0	6.0	3.7	3.0	5.2	5.2	5.4	5.3	5.4	4.6	5.1	5.0	
PST-R6T9S	5.2	5.2	5.2	4.3	4.7	3.7	4.0	5.3	5.5	5.8	4.9	5.4	4.8	5.3	4.3	
RIVIERA	5.6	4.3	5.6	3.3	4.7	3.7	6.0	4.7	4.8	5.3	6.0	5.3	4.7	5.3	4.0	
YUKON	6.0	5.0	5.4	3.3	6.3	3.0	8.7	5.7	5.2	5.5	5.3	5.2	5.0	5.1	4.0	
JSC 2009-6-S	5.8	4.0	5.1	3.8	5.0	2.7	4.7	5.2	5.2	5.3	5.1	5.3	4.8	5.3	4.0	
PST-R6P0	5.3	4.5	5.5	4.0	5.0	3.0	4.0	4.8	4.8	5.8	4.8	5.2	4.7	5.2	4.0	
BAR C291	5.8	4.5	5.1	3.8	4.3	3.0	4.0	4.7	4.5	5.0	5.0	4.8	4.9	4.9	3.3	
NORTH SHORE SLT	5.9	5.2	5.1	3.4	5.0	3.7	4.7	4.8	4.8	5.4	4.9	4.8	4.1	5.4	3.3	
OKS 2011-4	5.3	4.5	5.2	4.0	5.3	3.0	4.7	5.0	4.5	5.0	4.9	5.0	4.7	4.9	3.7	
OKS 2009-3	5.3	4.5	4.7	3.8	4.7	3.3	4.3	4.7	4.3	5.2	5.3	4.6	4.3	5.0	3.3	
NUMEX-SAHARA	5.3	4.5	4.7	4.3	4.3	3.3	3.7	4.7	4.3	4.7	4.8	4.7	4.6	4.8	3.0	
OKS 2011-1	6.3	4.8	4.9	3.4	4.3	2.7	4.0	3.8	4.4	4.8	4.9	4.9	4.3	4.6	3.7	
MSB 281	5.2	3.5	6.3	4.3	5.7	2.0	9.0	4.7	5.5	5.0	4.7	4.2	3.9	4.0	2.3	
LSD VALUE	0.7	1.1	0.6	1.9	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	2.6	1.0	1.2	
C.V. (%)	12.9	18.3	10.7	22.6	11.6	18.0	9.7	15.6	14.9	13.6	14.8	15.2	33.7	18.1	16.3	

1/ TO DETERMINE STATISTICAL DIFFERENCES AMONG ENTRIES, SUBTRACT ONE ENTRY'S MEAN FROM ANOTHER ENTRY'S MEAN. STATISTICAL DIFFERENCES OCCUR WHEN THIS VALUE IS LARGER THAN THE CORRESPONDING LSD VALUE (LSD 0.05).

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Turfgrass Producers of Texas



<https://texasgrass.com/>

Questions?

