Drought Tolerance of Warm-Season Turfgrasses Tested on the Linear Gradient Irrigation System

November 8th, 2017

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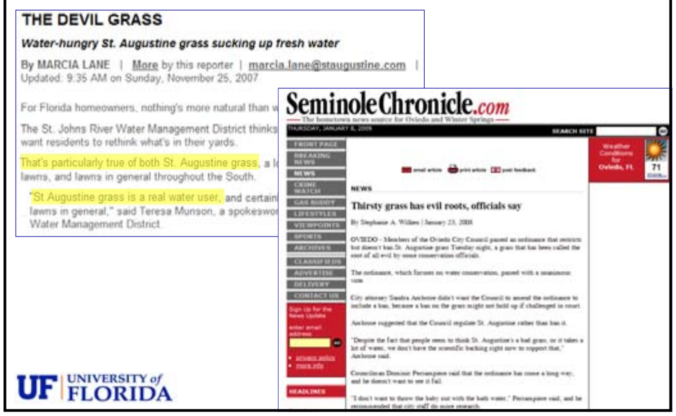

THE DEVIL GRASS

Water-hungry St. Augustine grass sucking up fresh water

By MARCIA LANE | More by this reporter | marcia.lane@staugustine.com |
Updated: 9:35 AM on Sunday, November 25, 2007

For Florida homeowners, nothing's more natural than w

The St. Johns River Water Management District thinks
want residents to rethink what's in their yards.

That's particularly true of both St. Augustine grass, a l
lawns, and lawns in general throughout the South.

"St Augustine grass is a real water user, and certain
lawns in general," said Teresa Munson, a spokeswo
Water Management District.

SeminoleChronicle.com

NEWS

Thirsty grass has evil roots, officials say

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St. Johns River Water Management District

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Watering restrictions

For more information, questions or to report violations, please call (800) 232-0904.

Know Your Days

Mandatory lawn watering restrictions specify the days when you may water. These days depend on whether you have an odd or even numbered address, and the time of year.

Time of year	Homes with odd numbered or no addresses	Homes with even numbered addresses	Nonresidential properties
Daylight saving time	Wednesday/Saturday	Thursday/Sunday	Tuesday/Friday
Eastern Standard Time	Saturday	Sunday	Tuesday

- Daylight saving time: Second Sunday in March until the first Sunday in November
- Eastern Standard Time: First Sunday in November until the second Sunday in March
- An odd numbered address is one that ends in 1, 3, 5, 7 or 9.
- An even numbered address is one that ends in 0, 2, 4, 6 or 8.
- Water only when needed and not between 10 a.m. and 4 p.m.
- Water for no more than one hour per zone.
- Restrictions apply to private wells and pumps, ground or surface water and water from public and private utilities.
- Some exceptions apply.

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Drought Tolerance vs. Drought Resistance

- Drought Resistance = the ability of a plant to survive prolonged drought stress through various mechanisms:
  - Drought Tolerance
    - Escape
    - Hardiness
  - Drought Avoidance
    - Limiting factors influencing soil water uptake
      - deep rooting
      - root viability
      - resistance to soil stresses
    - Limiting evapotranspiration (ET)

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A better phrase may be: *Drought Response*

- Grasses undergo many changes in *response* to drought.
  - Many of these responses go unnoticed but have a profound effect on the plant's ability to withstand drought.
    - Some are often very difficult to quantify.
  - Others are readily observed and easily quantified.

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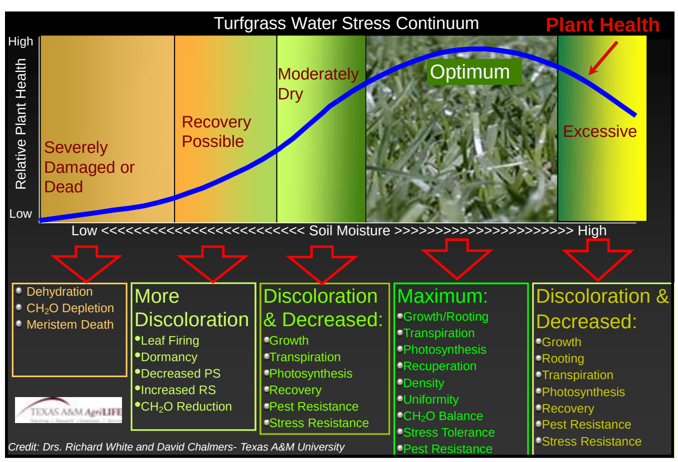

Credit: Drs. Richard White and David Chalmers- Texas A&M University

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Drought Tolerance

- Ability of a turfgrass to tolerate a drought period.
  - Escape – the plant has a life cycle such that it lives through the drought in a dormant state or as seed.
  - Hardiness – the plant develops a greater hardiness to low tissue water deficits.
    - Drought tolerance of protoplasm and protoplasmic membranes from alterations in their properties, and binding of water to protoplasmic constituents.
    - Osmotic adjustments to maintain adequate tissue water content.

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The plant is able to maintain adequate tissue water content and thus ***avoid*** or postpone the stress.

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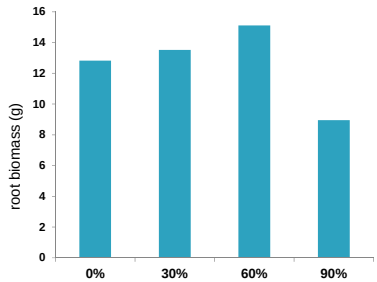
Influence of Drought on Turfgrass Rooting



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Comparative Turfgrass ET Rates and Associated Plant Morphological Characteristics

- Canopy Resistance
  - Shoot Density
  - # Leaves / Area
  - Leaf Orientation
- Total Leaf Area = Evaporative Area
  - Leaf Width
  - Vertical Leaf Extension Rate

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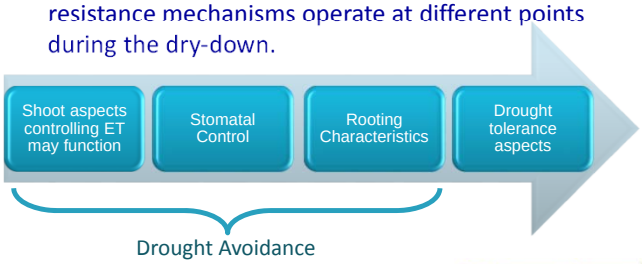
So what's the bottom line?

- As a drought is imposed on a grass, various drought resistance mechanisms operate at different points during the dry-down.



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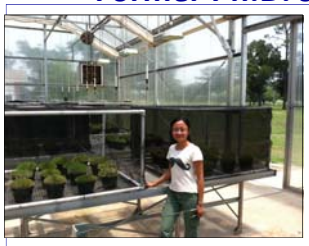
Jing Zhang and Bishow Poudel

Former Ph.D. students @ UF



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Materials and Methods

- Greenhouse dry down study
  - RCBD with 4 replications acrylic tubes (3.8 X 90 cm) and fritted clay
  - Controlled dry down: less than 10% of available soil water reduced every day

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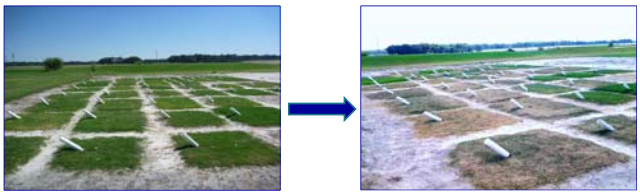
Materials and Methods

- Field dry down study
  - Location: Plant Research and Education Unit (PSREU)



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Linear Gradient Irrigation System (LGIS)

- Previous studies on LGIS (Banuelos et al., 2011; Peacock, 2001; Qian and Engelke, 1999)
  - Determine minimal and optimal water requirements
  - Evaluate drought responses of different species and cultivars

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Materials and Methods

- Plot establishment (RCBD with 4 replications)
- Plot size (10' × 80')
- Irrigation (twice weekly, 120% of ET_0)

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Materials and Methods

- Zoysiagrass
  - Toccoagreen, Zeon, Zorro, Emerald, Cavalier, El Toro, Empire, JaMur, Palisades, 'BA-189'
- St. Augustinegrass
  - Floratam, Classic, Palmetto, Raleigh, Sapphire, Captiva
- Bermudagrass
  - Common, Celebration, Princess 77, TifTuf, Tifton 10
- Seashore Paspalum
  - Aloha, SeaDwarf, Sealsle Supreme
- Bahiagrass
  - Argentine
- Centipedegrass
  - Common, TifBlair
- Buffalograss
  - Density

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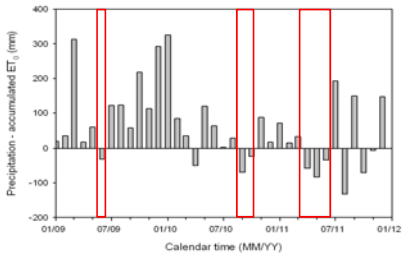
Materials and Methods

- Identified dates of drought periods:



  - June, 2009
  - September, October, 2010
  - May, June, and July, 2011

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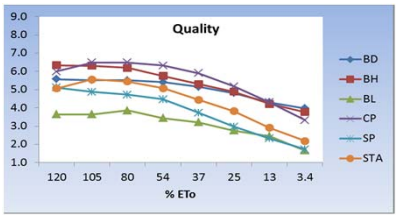
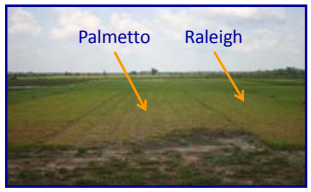
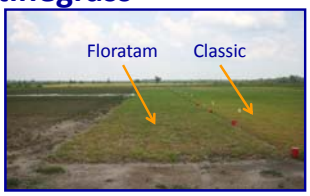


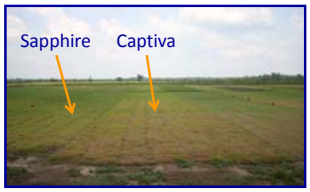
	120%	105%	80%	54%	37%	25%	13%	3%
BD†	5.6 b	5.5 b	5.5 b	5.4 b	5.2 b	4.8 a	4.3 a	4.0 a
BH	6.3 a	6.3 a	6.2 a	5.7 ab	5.3 ab	4.9 a	4.2 a	3.8 ab
BL	3.6 d	3.6 d	3.9 d	3.4 e	3.2 d	2.8 c	2.4 bc	1.7 c
CP	6.0 a	6.5 a	6.5 a	6.3 a	5.9 a	5.2 a	4.3 a	3.3 b
SP	5.1 c	4.9 c	4.7 c	4.5 d	3.7 d	3.0 c	2.3 c	1.7 c
STA	5.1 c	5.6 b	5.4 b	5.1 c	4.4 c	3.8 b	2.9 b	2.2 c

†BD: bermudagrass; BH: bahiagrass; BL: bufflograss; CP: centipedegrass; SP: seashore paspalum; STA: St. Augustinegrass

St. Augustinegrass







Results

- Among St. Augustinegrass cultivars - Palmetto had lower quality compared with Captiva, Classic, Floratam and Raleigh except when irrigation level was more than 80% ET_o.
  - These 4 cultivars had similar quality, and they performed no differently with Argentine bahiagrass at 37-105% ET_o irrigation level.
- This indicates St. Augustinegrass can perform equivalently to bahiagrass when certain levels of irrigation is applied.
  - In this case, more than 37% ET_o.

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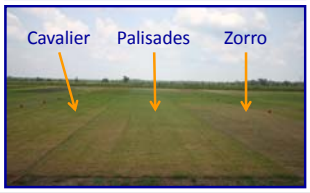
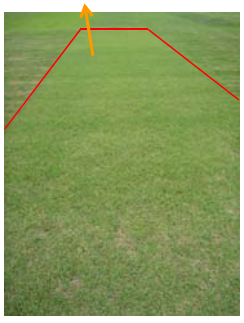
Zoysiagrass



Palisades under non-drought condition



Zorro under drought condition

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Zoysiagrass Conclusions

- Irrigation requirement of zoysiagrass
  - 54-80% ET_0 irrigation is needed to prevent turf quality decline below 5.5
- Excess irrigation had negative effect on turf quality of zoysiagrass
  - Future study
    - Root penetration
    - Disease and weeds

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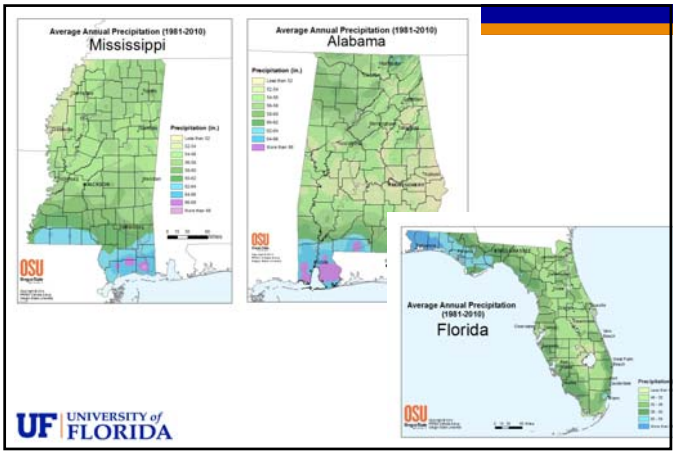

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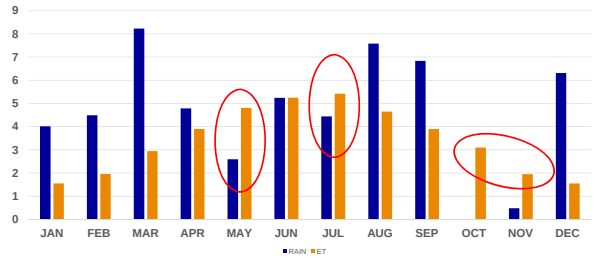
Rainfall vs. Evapotranspiration - 2016

Florida Panhandle (Carrabelle/Jay)



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Irrigation Needs – Florida Panhandle

	Daily ET	Weekly ET	67%
JAN	0.05	0.35	0.23
FEB	0.07	0.49	0.33
MAR	0.10	0.67	0.45
APR	0.13	0.91	0.61
MAY	0.16	1.09	0.73
JUN	0.18	1.23	0.82
JUL	0.18	1.23	0.82
AUG	0.15	1.05	0.70
SEP	0.13	0.91	0.61
OCT	0.10	0.70	0.47
NOV	0.07	0.46	0.30
DEC	0.05	0.35	0.23

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Water

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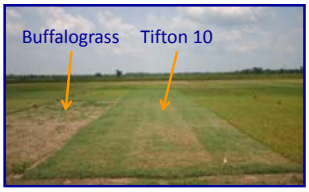
Bermudagrass & Buffalograss



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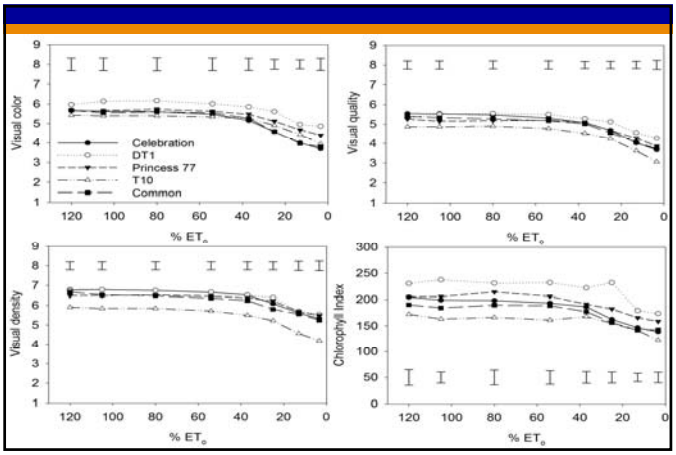

Cultivar comparison

- Bermudagrass (BD) genotypes comparison
  - T10 (lower color, quality, and density ratings, and lower Chlorophyll index)
  - TifTuf had higher chlorophyll index (CI) than other bermudagrass genotypes (except Princess 77) when the irrigation level was < 105% ET_o.
    - Although visual ratings provided less separation, TifTuf maintained higher quality at all irrigation levels.

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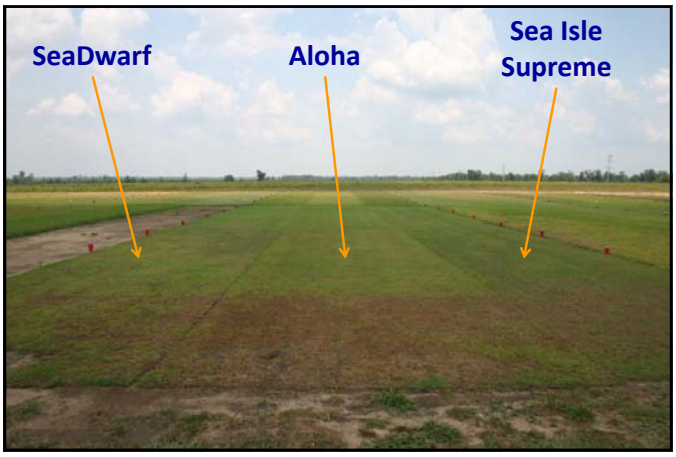
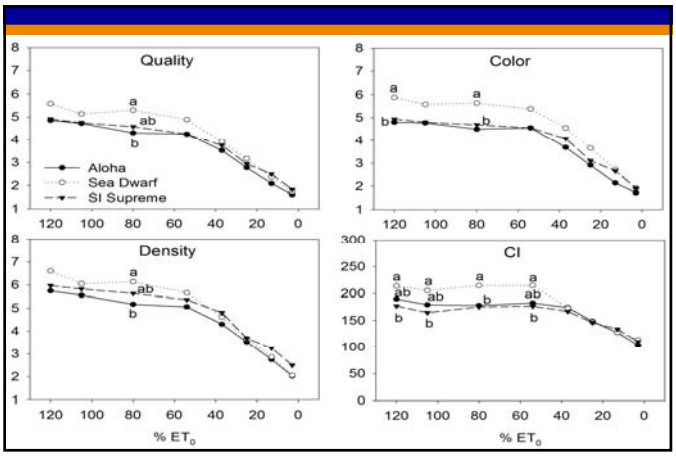
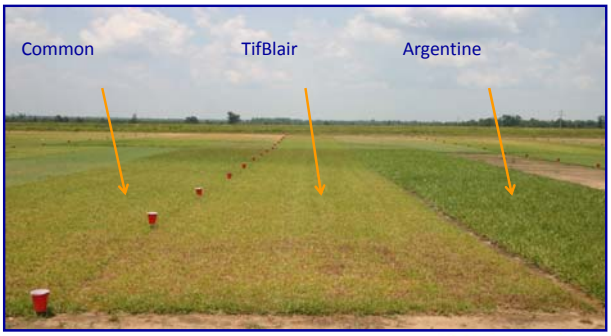




Centipedegrass & Bahiagrass



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Results

- Common and TifBlair centipedegrass - rated in the top group along all irrigation levels.
  - Argentine bahiagrass was rated similarly in quality to centipedegrass
- Centipedegrass and bahiagrass require less supplemental irrigation to maintain acceptable quality compared to St. Augustinegrass cultivars.

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Preliminary Observations

- All grasses respond to drought – they just do it differently.
  - Zoysigrasses wilt and fire very quickly and very uniformly (green → brown).
  - St. Augustinegrass fades over time with some green foliage lingering for weeks (green → yellow-green → yellow → brown).
  - Centipedegrass wilts quickly but also recovers (turns green again) very quickly.
  - Seashore paspalum can be very slow to recover due to the plant's priority on producing below-ground plant parts.
  - Bermudagrass and bahiagrass are very drought responsive but may not provide the desired turf quality.

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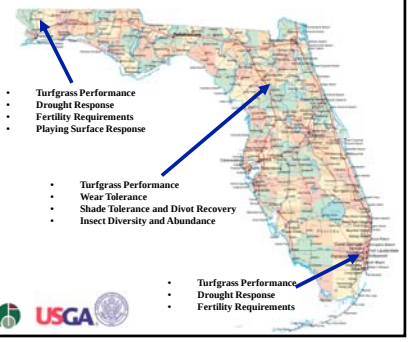
Multi-Location Trial to Establish Maintenance Requirements and Performance of New Bermudagrass Cultivars for Fairway Use

- Bermudagrass Cultivars:
  - Tifway 419 Celebration
  - TifGrand
  - TifTuf
  - Latitude 36
  - Bimini
  - Premier Pro (GNV & JAY)



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