Water Use in Warm-season vs. Cool-season Turfgrasses

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• The frog does not drink up the pond in which he lives.
  – American Indian Saying

• I bought some instant water one time but I didn’t know what to add to it.
  – Stephen Wright

• Whiskey if for drinking; water is for fighting over.
  – Mark Twain
The $64 Question

• Should I plant a warm-season or a cool-season grass?

• The recent droughts have municipalities taking stock of water supplies. Some have even paid homeowners to switch to a warm-season turf. Is there good reason to switch?
Turf from Space
Everything is Relative

Consumptive Water Use in Southern Nevada

- Single-Family Residential: 44.0%
- Multi-Family Residential: 15.0%
- Commercial Industrial: 13.0%
- Golf Courses: 7.0%
- Resorts: 7.0%
- Schools/Govt./Parks: 5.0%
- Common Areas: 5.0%
- Other: 4.0%

Based upon 2006 municipal metered potable and non-potable water use in the Southern Nevada Water Authority’s metered service area.

Total Residential Water Use

- Effective landscape outdoor usage: 47%
- Wasted landscape water: 23%
- Toilet: 8%
- Laundry: 6%
- Shower: 5%
- Faucet: 5%
- Leaks: 4%
- Baths, dishwasher, miscellaneous: 2%

Outdoor: 70%
Indoor & Leaks: 30%
Warm vs. Cool

• Warm-Season
  – Bermudagrasses
  – Zoysiagrasses
  – Centipede grass
  – Bahiagrass
  – St. Augustinegrass
  – Carpetgrass

• Cool-Season
  – Tall fescue
  – Fine fescues
  – Kentucky bluegrass
  – Perennial ryegrass
  – Creeping bentgrass
Grasses Under Various Stress Levels
Warm vs. Cool - Homeowners

- **Warm-Season**
  - Bermudagrasses
  - Zoysiagrasses
  - Centipede grass
  - Bahiagrass
  - St. Augustine grass
  - Carpet grass

- **Cool-Season**
  - Tall fescue
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  - Creeping bent grass
There is a Relationship Between Turf Quality and Water Use

Turf Quality

Applied water - % of Evapotranspiration

Acceptable
Factors that Affect Turfgrass Water Use

- Growth rate
- Climatic conditions --- ET rate
- Length of growing season
- Soil type
- Turfgrass species and cultivar
- Rainfall
- Intensity of culture
- Available soil moisture
## ET Rates for Common Turfgrasses
(compiled from various researchers)

<table>
<thead>
<tr>
<th>Species</th>
<th>Range of Evapotranspiration (mm/day)</th>
<th>Range of Evapotranspiration (inches/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall Fescue</td>
<td>7.2-13.0</td>
<td>2.0-3.5</td>
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<tr>
<td>Perennial Ryegrass</td>
<td>6.6-11.2</td>
<td>1.8-3.1</td>
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<tr>
<td>St. Augustinegrass</td>
<td>6.3-9.6</td>
<td>1.7-2.6</td>
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<tr>
<td>Creeping Bentgrass</td>
<td>5.0-9.7</td>
<td>1.3-2.7</td>
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<tr>
<td>Centipedegrass</td>
<td>5.5-8.5</td>
<td>1.5-2.3</td>
</tr>
<tr>
<td>Bermudagrass</td>
<td>4.0-8.7</td>
<td>1.0-2.2</td>
</tr>
<tr>
<td>Zoysiagrass</td>
<td>4.8-7.6</td>
<td>1.3-2.1</td>
</tr>
<tr>
<td>Kentucky Bluegrass</td>
<td>4.1-6.6</td>
<td>1.1-1.8</td>
</tr>
</tbody>
</table>
C3 vs C4 Photosynthesis

• Warm-season and cool season grasses have a fundamental difference in the way they each capture energy through photosynthesis. Warm season grasses have a distinct advantage during periods of high light, heat, and drought. Why?
The Stomatal Cavity

Diagram depicting the stomatal cavity with labeled parts such as boundary layer, guard cells, epidermal cells, mesophyll cells, vascular bundle, and atmospheric H₂O flow.
Stomates Open – CO$_2$ Flows in
Drought – Stomates Closed, CO$_2$ Restricted in Cool-season Turf. Photosynthesis is minimal.
Drought – Stomates Closed, but CO$_2$ is Concentrated in Warm-season Turf. Photosynthesis is maintained.
Summary of Physiology

- Under summer conditions, warm-season grasses can conserve water by closing stomates while maintaining photosynthesis. This gives them a distinct advantage over cool season grasses.

- But it doesn’t mean they won’t experience drought stress or express symptoms.
When is the Irrigation Season?

Jan       Mar        May                   Aug          Sep      Oct          Nov

Cool-Season

Warm-Season
Irrigation Scheduling

- Deficit irrigation (replacing less than full ET) is a successful management practice
  - Tall fescue can be irrigated at ~80% of ET
  - Bermuda/zoysia can be irrigated at ~65% of ET
So What’s the Deal?

- It sounds like warm-season is the way to go, right? They use less water than cool-season on a per day basis, they have a shorter irrigation season, many have rhizomes for long-term survival, and perform well with deficit irrigation. It’s a no-brainer, right?
Wrong - Nothing’s ever a no-brainer

Water savings is only one thing to consider when choosing a grass, and not the most important factor. Sun vs. shade, climatic zone, client expectations, budget, management capability, etc. are equally or more important

- Under real world conditions, the difference between warm- and cool-season turf in water use is not nearly as great. And tall fescue is quite capable of surviving for weeks as dormant turf.
- Inefficient irrigation systems waste much more water than might be saved by picking one grass over another. Correct the big problems first. Until you do, the little problems don’t matter. And species water use rate is a little problem.
If Water Conservation Were the Only Consideration, Buffalograss would be the Obvious Choice!

- Uses ~60% as much water as tall fescue
- Stays green with ~35%
- Survives as dormant grass for a season
- Heat and cold tolerant
- So why isn’t it used in NC?
If Water Conservation Were the Only Consideration, Buffalograss would be the Obvious Choice!

- So why isn’t it used in NC?
- Hates acid soils
- Hates high humidity
- Hates wet soils
- Has little or no disease resistance
- Can’t compete with weeds
- Where it’s good, it’s very good, and where it’s bad, it’s awful
The SAWS Drought Study in 2006 evaluated 25 warm-season grasses on either a 4-inch soil depth or the native, unrestricted soil.
Irrigation Uniformity Critical to Saving Water
Ideal Uniformity
Actual Uniformity
Over Irrigation to Compensate
Best Turfgrass Management Practices

- Increase mowing height if feasible.
- Provide adequate nutrition, especially N & K.
- Avoid excessive levels of N. One study indicated that high N fertility can increase water use by 41% over low N fertility.
- Tune up your irrigation system – conduct an audit.
- Practice deficit irrigation. Know how much is being applied.
- If turf goes dormant, let it stay dormant unless you commit to regular irrigation. Do not stop and start and then stop again.
- Improve soils to increase rooting depth.