Optimizing Bermudagrass Athletic Field Winter Survival in the Transition Zone

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THE TRANSITION ZONE

- Cool humid winters
- Cool mild summers

- Warm dry summers
cold dry winters
low rainfall 10 - 20 inches

- Transition Zone Climate

- Hot dry summers, cold dry winters
low rainfall (10 - 20 inches)

- Hot humid summers,
mild winters, 40 - 60 inches rainfall

- Cool summers,
variable humidity
cold winters

- Hot summers,
variable humidity
cold winters
Warm Season Turfgrass Zones

(Based on low temperature exposure)

- PRIMARY ZONE
- SECONDARY ZONE
- NEW ZONE?
2016 was 2nd warmest year on record for U.S.

15 weather and climate disasters caused 138 deaths, $46B in damages

2017 was 3rd warmest year on record for U.S.

16 billion-dollar weather and climate disasters made for costliest year on record

AROUND NOAA //

What are atmospheric rivers?

Periods of greater Atlantic hurricane linked to weaker U.S. landfalls

Postscript: Lost WWII weatherman

AROUND NOAA //

Snow squall warnings to begin this winter

NOAA kicks off 2018 with massive supercomputer upgrade

GOES-13 satellite retires from 10 years of stellar service, replaced by GOES-16
Three-Month Outlooks
OFFICIAL Forecasts
Feb-Mar-Apr 2018

Click here for information about the three-month outlook

[UPDATED MONTHLY FORECASTS SERVICE CHANGE NOTICE]
[EXPERIMENTAL TWO-CLASS SEASONAL FORECASTS]
The EPA predicts...

- Average summer temperatures will increase by $3^\circ \text{F}$ over the next few decades and could increase by over $10^\circ \text{F}$ by the end of the century.
The old USDA hardiness map
The new USDA hardiness map
Winter Comes to the Transition Zone but How Long/Severe varies each year
Winterkill!!!
## Air Temperatures
**Lexington, KY Winter ‘17-’18**

<table>
<thead>
<tr>
<th>Date</th>
<th>Low Temperature (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 27</td>
<td>10</td>
</tr>
<tr>
<td>Dec. 28</td>
<td>10</td>
</tr>
<tr>
<td>Dec. 29</td>
<td>14</td>
</tr>
<tr>
<td>Dec. 30</td>
<td>12</td>
</tr>
<tr>
<td>Dec. 31</td>
<td>8</td>
</tr>
<tr>
<td>Jan. 1</td>
<td>3</td>
</tr>
<tr>
<td>Jan. 2</td>
<td>-2</td>
</tr>
<tr>
<td>Jan. 3</td>
<td>4</td>
</tr>
<tr>
<td>Jan. 4</td>
<td>8</td>
</tr>
<tr>
<td>Jan. 5</td>
<td>7</td>
</tr>
<tr>
<td>Jan. 6</td>
<td>1</td>
</tr>
</tbody>
</table>

Highest daytime temperature during this period = 30 °F
Photos taken Jan. 12, 2018
# Blue Grass Airport 10 Day Weather

<table>
<thead>
<tr>
<th>DAY</th>
<th>DESCRIPTION</th>
<th>HIGH / LOW</th>
<th>PRECIP</th>
<th>WIND</th>
<th>HUMIDITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TODAY</td>
<td>Wintry Mix</td>
<td>35°/14°</td>
<td>80%</td>
<td>N 17 mph</td>
<td>89%</td>
</tr>
<tr>
<td>SAT</td>
<td>Partly Cloudy</td>
<td>25°/9°</td>
<td>10%</td>
<td>N 12 mph</td>
<td>60%</td>
</tr>
<tr>
<td>SUN</td>
<td>Mostly Sunny</td>
<td>26°/15°</td>
<td>0%</td>
<td>E 6 mph</td>
<td>56%</td>
</tr>
<tr>
<td>MON</td>
<td>PM Rain/Snow Showers</td>
<td>38°/3°</td>
<td>40%</td>
<td>SSW 15 mph</td>
<td>58%</td>
</tr>
<tr>
<td>TUE</td>
<td>Cloudy</td>
<td>12°/2°</td>
<td>20%</td>
<td>W 9 mph</td>
<td>72%</td>
</tr>
<tr>
<td>WED</td>
<td>AM Clouds/PM Sun</td>
<td>23°/7°</td>
<td>10%</td>
<td>W 9 mph</td>
<td>70%</td>
</tr>
<tr>
<td>THU</td>
<td>Mostly Sunny</td>
<td>31°/19°</td>
<td>10%</td>
<td>SW 9 mph</td>
<td>60%</td>
</tr>
<tr>
<td>FRI</td>
<td>Partly Cloudy</td>
<td>42°/31°</td>
<td>0%</td>
<td>SSW 10 mph</td>
<td>65%</td>
</tr>
</tbody>
</table>
Causes of Winterkill

- Direct low temperature kill (varies with cultivar)
  - Duration of cold also a factor
- Heavy shade
- Poor drainage
- North facing slopes
- High spots (desiccation)
- Extended ice cover
- Winter traffic
- Heavy thatch
- Plant health
Optimizing Bermudagrass Athletic Field Winter Survival in the Transition Zone

Gregg Munshaw, Plant and Soil Sciences, University of Kentucky; Cale A. Bigelow, Agronomy, Purdue University; Michael Goatley, Crop and Soil Environmental Sciences, Virginia Polytechnic Institute and State University (Virginia Tech); Brad Fresenburg, Plant Sciences, University of Missouri

Bermudagrass is an excellent choice for use on athletic fields throughout the transition zone (which includes Virginia, Kentucky, southern Indiana, and Missouri) because of its tolerance to close (e.g. < 1”) cutting heights, summer vigor, positive traction characteristics for athletes, resistance to divoting and ability to withstand and recover from significant traffic during active growth. The major limitation to successful bermudagrass persistence in transition zone locations is a general lack of cold tolerance and susceptibility to winterkill (Figure 1). Although during most winters temperatures are sufficiently warm enough to optimize the performance of common bermudagrass cultivars, there are many newer cultivars that are still available in the marketplace. Many of the older cultivars, however, do not have the improved turf quality characteristics such as increased shoot density, finer leaves, improved wear and recovery characteristics, and less susceptibility to scalping that are common in many newer cultivars. Bermudagrass cultivars commonly grown in the transition zone include Latitude 36, Northbridge, Patriot, Premier Pro, Quickstand, Riviera, VaMont, and Yukon. To view the list of the top performing bermudagrasses in the transition zone, see www.ntep.org.
Mowing

- During active growth (summer), 0.5-1.0 inches
- Early fall, 1.0-1.5 inches
  - Increased CHO production and storage
  - Insulation
  - More leaf tissue may resist wear = longer seasonal durability
- Slight increases should not affect playability/ball roll
Overseeding
Overseeding
(What we know or think we know)

- PR is species of choice for athletic fields
- Suggested planting rates range from 218-1311 lbs/ac (Goatley, 2008; McCarty, 2016)
- Overseeded bermuda often has density issues in spring
- Bermuda needs 60-100 days with no competition to replenish CHO's (Askew, 2010)
Overseeding Research

- Planted Futura 2000 at 0, 655, and 1310 lbs/ac
- Measured canopy temperatures through winter
- Measured CHO status through winter
- Monitored bermuda cover in spring

Images: (A.) The winter overseeded study area in Lexington, KY, (B-C.) Soil temperature monitoring equipment used to document the impact of overseeding on soil temperatures, (D.) removed cores from non-overseeded and winter overseeded bermudagrass ready for separation of stem tissue from soil for carbohydrate analysis, (E.) effects of the winter overseeding on bermudagrass spring green-up and density in Lexington, KY-2015.
Overseeding Research

- Improved visual appearance in fall/winter
- Reduced spring density
- CHO reductions through winter—no effect from PR
- Only a slight temperature increase (+1.1°F)
Traffic Management

Dormant bermuda unable to recover following wear—Results in thin turf if excessive traffic
<table>
<thead>
<tr>
<th>Best Traffic Tolerance</th>
<th>Not The Best Traffic Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tifway</td>
<td>Princess</td>
</tr>
<tr>
<td>Astro</td>
<td>Yukon</td>
</tr>
<tr>
<td>Tiftuf</td>
<td>Kashmir</td>
</tr>
<tr>
<td>North Shore</td>
<td>Celebration</td>
</tr>
<tr>
<td>Numex-Sahara</td>
<td></td>
</tr>
<tr>
<td>Latitude 36</td>
<td></td>
</tr>
<tr>
<td>Patriot</td>
<td></td>
</tr>
<tr>
<td>Riviera</td>
<td></td>
</tr>
</tbody>
</table>
Traffic Tolerance: Cultivar Differences

Riviera
Latitude 36
Tifway
# Spring Greenup Following Traffic

<table>
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<tr>
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<th>Not The Best</th>
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<tr>
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<td></td>
<td>Tifway*</td>
</tr>
<tr>
<td></td>
<td>Celebration</td>
</tr>
</tbody>
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Winter Traffic

Feb. 16, 2008

Mar. 20, 2008

• Spring recovery/greenup in March approximately 50% for control plots, 15% for drained traffic, and <10% for wet traffic.

• Control areas reached 100% spring recovery/greenup in April vs. June for the areas receiving winter traffic.
Traffic Management

- Wet Fields result in soil displacement, poor footing, turf ripping
- Play on wet fields causes increased compaction (harder surface may equal more injuries)
The key to a successful athletic field is 90% drainage and 10% common sense. If you don’t have enough common sense, install more drainage.”

--Mike Goatley
A-1. Any soil system.
End Section Crown for Football Fields Constructed with Native Soil

- Crown: 12 to 18"
- Slope: 1 - 1.75%
IMPROVING POOR SOILS--

COMPACTION

- is a physical condition of soil resulting from the compression of the soil into a relatively dense mass... a reduction in macropore space
  - occurs in areas of high foot and/or vehicle traffic
  - mostly confined to the top 3-4 inches of the soil
Importance of Soil Aeration:

- Root growth --
- Gas exchange... replace CO$_2$ and other possibly toxic gases with oxygen
- Microbial activity is supported by adequate aeration
Measuring surface hardness with Clegg Impact Soil Tester
Use lots of signs with specific instructions.
Nutrition
Nutrition

- Soil test!
- 0.5-1.0 lbs N/1000 sq ft/growing month

Bermudagrass winterkill in Kentucky following summer nitrogen applications
Nutrition

- Judicious N apps in fall provide a little color but promote winter weeds

- Potassium ‘winterizer’
  - K can increase in cell sap and act as an antifreeze
  - If soil test K is adequate, little benefit is gained by adding more and may overload exchange sites in soil limiting availability of other nutrients
Managing Bermudagrass in the Transition Zone

3 Keys to Management from a Sports Turf Manager

Fertility plan “feeding the soil”

Newer varieties (Latitude 36 and Northbridge vs Tifway 419)

Using growth blankets in the spring and fall to get a head start and prolong the growing season
“FEEDING THE SOIL”

• Feeding the soil basic philosophy
  o Using less synthetic granular fertil, more organic sources
  o Using less granular N, more liquid N released by microbial activity
  o Spraying molasses
  o Spraying foliar products have high levels of amino acids for plant health
  o Making a real effort to build up the carbohydrate level in the plant
Covers

- Two basic philosophies
  - Set and forget
  - Prolong growing season

Bermudagrass spring greenup differences between a lightweight cover (left) and a turf blanket (right).
May 6, 2014 83/52
Temperature readings under the covers at the surface, 1” soil temp, and surface uncovered

- 4/18 84/48
- 4/19 83/50
- 4/20 84/56
- 4/21 76/62
- 4/22 71/54
- 4/23 69/53
1.5” Soil Temps 1/11/18

- **Baseball** (native soil) covered 50.8, uncovered 42
  3oz woven polypropylene
- **Practice Football** (10” USGA) covered 48.3, uncovered 49.4
  4oz non woven polypropylene
- **Game Soccer** (sand cap) covered 48, uncovered 41.8
  3oz woven polypropylene
  **Practice Soccer** (sand cap) covered 47.7, uncovered 47.5
  2.7 oz polypropylene core sheathed in polyethylene
- **Softball** (native soil) uncovered 41.4
6/8/12, the first year of blankets in the spring and almost 1 year of “feeding the soil” plan
5/1/15 and 4/25/16
5/1/15 and 4/25/16
5/1/15 and 4/25/16
5/1/15 and 4/25/16
5/1/15 and 4/25/16
5/1/15 and 4/25/16
Average Temperature and Total Rainfall Lexington, KY

Dec 1-March 15

Year

- 2010 39-26-9.24"
- 2011 40-27-14.85"
- 2012 50-33-12.77"
- 2013 46-31-13.97"
- 2014 43-25-14.17"
- 2015 41-26-13.99"
- 2016 50-34-15.19"
- 2017 50-34-16.49"
- 2018 42-24-2.74"

Days below freezing and low

- 2010 8, 2/10-2/17, 2
- 2011 7, 12/13-12/19, -2
- 2012 3, 1/13-1/15, 13, 28,294 sq ft.
- 2013 2, 2/1-2/2, 5, 22,665 sq ft.
- 2014 6, 2/6-2/11, -6, 15,081 sq ft.
- 2015 6, 2/15-2/20, -18, 13,000 sq ft. (used Latitude 36)
- 2016 7, 1/18-1/24, 4, 6300 sq ft.
- 2017 4, 1/5-1/8, 4, 1575 sq ft.
- 2018... 13 12/25-1/6, -3