Widespread Damage on Bentgrass Tees

Exposed Bentgrass Fairways Affected

Devastating Winterkill on Perennial Ryegrass
PRYE Interseeded into Kentucky Bluegrass

Most Damage to Greens was Isolated

Exposed Golf Courses Had Significant Loss

Covers Weren’t Always the Answer

Limited Use of Temp. Greens During Recovery

Thatchy Research Green Was Not Immune
Daily Equivalent Precipitation

Winter Precip

Total from December through March (inches)

Daily Peak Wind Gusts

2013-14 Gusts Averaged 30 MPH

Daily Air Temperatures

Air temperature [°F]

Daily maximum
Daily minimum
**Likely Cause of Winterkill**

- Perennial Ryegrass & Annual Bluegrass
  - Combination of direct low temperature kill and desiccation injury
  - Late-season applications of ethofumesate (Prograss)

- Creeping Bentgrass & Roughstalk Bluegrass
  - Winter Desiccation
    - LT$_{50}$ = -35°C (-31°F)
    - Thatchy, elevated crowns
    - Exposed locations

**Seasonal Variation in Cold Hardiness**

**Cold Hardiness Inversely Related to Crown Moisture Content**

**Excessive Crown Dehydration Reduces Cold Hardiness in Winter Cereal Crops**

Roth et al., 1970
Likely Link Between Cold Hardiness and Crown Moisture

Cold Hardiness

Bone Dry  Crown Moisture Content  Full of Water

UNL Winterkill Extension Efforts

- Frequent Turf Info
  - Comprehensive Guide to Winterkill
  - Winter Watering Info
  - Sampling Procedures
  - Frequent Re seeding Advice
  - Encouragement to Take Action
- Winterkill FAQ for Golfers
- Winterkill Damage Survey Monkey
- Winterkill Webinars
- Superintendent Meetings
- Site Visits

Slow Recovery

Middle May 2014

Early June 2014
Maximizing Winterkill Recovery

Darrell Michael
University of Nebraska-Lincoln
Treatments

- Heat treatment
  - Permeable (White)
  - Impermeable (Clear, holes punched on 1” centers)
  - Foursome (1.6 oz/M)
  - Weed barrier (black)
  - Control
- Seeded
  - Yes (2 lbs Seed/M)
  - No
- Bi-weekly Fertilization (lbs N/M)
  - 0
  - 0.1

Now we wait...

- Seeded April 4th
- 1 lb P₂O₅ at seeding & bi-weekly, 4 total applications
- Irrigated 4 times daily
- First germination in 6 days on April 10th
- Complete germination by April 18th (2 weeks)
- Mowed at .180” daily, slowly brought down
April 10 – 6 days after seeding

Soil Temperatures at Germination

<table>
<thead>
<tr>
<th>Heat Treatment</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed Barrier</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pigment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evergreen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Different letters above the different treatments denote a significant difference.

April 10 – 62°F
20-25 mph winds
Clear Skies

Quality of Seedling Germination

LSD = 0.5

Quality of Seedling Germination

LSD = 0.5

Quality of Seedling Germination

LSD = 0.5

Quality of Seedling Germination

LSD = 0.5

April 10 – 6 days after seeding
Check to see if plug are alive

- Hole saw drill bit
- Re-water and warm up
- Regrowth may take weeks

If death is feared...
Seed if dead

Promote soil warming through heat treatments

Cultural Practice are key to success

• Fertility - small amounts necessary
  – Starter fertilizer @ 1 lb P₂O₅ (Several apps every other week)
• Proper irrigation, mowing, and topdressing
• Stay off the turf if at all possible
• Watch weather for harmful diseases

Darrell Michael
University of Nebraska – Lincoln
michaeldarrell@ymail.com
402-853-4650