Subsurface Drip Irrigation for Sports Turf

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Subirrigation

Reasons for not gaining market acceptance:

• Lack of urgency to conserve water
• Cost
• Considered to be “unproven” technology, resistance to change
• Technology predominantly for tees and greens (how much water can you conserve on 6 to 8 acres (2.5 to 3.5 ha) when 100 acres (40 ha) are irrigated?)
• Performance questionable on sloping design
Alternative Irrigation Methods

Goals:
✓ Ensure player safety
✓ Maintain (increase) turf quality
✓ Increase irrigation efficiency through improved water distribution
✓ Eliminate human exposure to irrigation water
Subsurface Irrigation

- Extensively used in agriculture
- Slow to reach acceptance in turf
Microirrigation

Drip Irrigation

- Line Source (Precision Porous Pipe)
- Point Source (Netafim, Rain Bird, Toro)
- Combination (KISSS)

Subirrigation

- Cellsystem
- EPIC (ECS)
- Pat System, Purr-Wick System
For all the naysayers ...
The natural progression of a sprinkler system
Problems
Problems
DL2000® Series PC Dripline

No filters to change or chemically treated disks to handle.

Irrigation takes place at or below grade so there is minimal water loss due to mist, evaporation, run-off or wind.

Ideal for shrub areas, median strips, public recreation areas and parking islands.

Seven-year warranty against root intrusion.
SUBSURFACE DRIP IRRIGATION (SDI)

Wetting pattern

Wider (spacing) and deeper (placement) in finer soils
<table>
<thead>
<tr>
<th>Planning / Installation</th>
<th>(Perceived) Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacing / Depth</td>
<td>Water supply / Soil type / Grass</td>
</tr>
<tr>
<td>Lateral lengths (zoning)</td>
<td>Manufacturer</td>
</tr>
<tr>
<td></td>
<td>Emitter spec (Label)</td>
</tr>
<tr>
<td>Root intrusion</td>
<td>Emitter design / Herbicide</td>
</tr>
<tr>
<td>Emitter clogging</td>
<td>Filtration</td>
</tr>
</tbody>
</table>
## (Perceived) Challenges (2)

<table>
<thead>
<tr>
<th>Establishment / Maintenance</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Establishment from seed</td>
<td>Proper timing</td>
</tr>
<tr>
<td>Establishment from sod</td>
<td>Proper timing</td>
</tr>
<tr>
<td>Granular fertilization</td>
<td>Maintain soil moisture</td>
</tr>
<tr>
<td>Salt build up / leaching</td>
<td>Grass selection / below drip lines</td>
</tr>
<tr>
<td>Aerification</td>
<td>n.a./drip line depth/ root zone selection</td>
</tr>
</tbody>
</table>
Irrigation Uniformity
Irrigation Uniformity

- Sprinkler irrigation (DU > 0.75) resulted in more uniform soil moisture distribution (lower standard deviation values) when compared to drip irrigation on 13 out of 18 sampling dates.

- Water quality affected moisture uniformity on 15 out of 18 sampling dates. Saline irrigated plots had soil moisture distributed more uniformly than potable irrigated plots.
Performance / Longevity

No reduction in quality when turfgrasses were irrigated with potable water from a subsurface drip system over several years


• Leinauer, B. and D. Devitt. IN PRESS. Irrigation science and technology. In B. Horgan, J. Stier, S. Bonos (eds.) Turfgrass Monograph. ASA, CSSA, and SSSA, Madison WI.
## Establishment of Warm and Cool-Season Grasses under Subsurface Drip and Sprinkler Irrigation

<table>
<thead>
<tr>
<th></th>
<th>Warm Season</th>
<th>Cool Season</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species</strong></td>
<td>Bermudagrass ‘Princess 77’ Seashore paspalum ‘Sea Spray’</td>
<td>Tall fescue ‘Justice’ Kentucky bluegrass ‘Barduke’</td>
</tr>
<tr>
<td><strong>Seeding</strong></td>
<td>Mar and Jun 2008 and 2009</td>
<td>Sep 2009 and Oct 2010</td>
</tr>
<tr>
<td><strong>Irrigation</strong></td>
<td>Toro DL2000 MP Rotator / Toro Precision™ Series 100% ETo</td>
<td>Membrane covered drip system (KISSS America) Toro Precision™ Series 120% ETo</td>
</tr>
<tr>
<td><strong>Water Quality</strong></td>
<td>Potable Saline (1800 ppm, SAR 4.0)</td>
<td></td>
</tr>
</tbody>
</table>
Subsurface Drip Irrigation

Toro DL2000

KISSS (Kapillary Irrigation Subsurface System)
October 15\textsuperscript{th}

March seeded, saline and drip irrigated bermudagrass

June seeded, saline and drip irrigated seashore paspalum
Summary

• Early planting will establish warm season grasses quickly and successfully
• Saline water can be used in combination with sprinkler and subsurface drip irrigation for establishment (both seed and sod)
• Warm season grasses establish best under drip irrigation when seeded or sodded early

Summary (contd.)

- CS establishment was successful for both years
- Spacing between drip lines needs to be carefully evaluated
- Salinity problems may arise for CS grasses if subsurface drip is used with saline water

Bermudagrass NTEP variety trial
Subsurface drip irrigated with saline water

Summer 2009

November 2009
Drip irrigation with saline water

Subsurface or Sprinkler?
Results

Cool season grasses

• Changes in soil EC, Na content, and SAR reflected seasonal changes in irrigation and natural precipitation
• Greatest EC and Na values were reached in June of 2006 on drip irrigated plots at depths of 0 – 10 cm
• Only tall fescue maintained acceptable quality when irrigated with saline water
• More than one stressor affected quality
Results

Warm season grasses

- EC, Na, or SAR did not affect turf quality
- Turf quality:
  Seashore paspalum > Princess 77, Riviera
- Drip irrigation resulted in earlier green-up than sprinkler irrigation but had no effect on summer quality or fall color retention

Sevostianova et al., 2011. Soil Salinity and Quality of Sprinkler and Drip Irrigated Warm-Season Turfgrasses. Agronomy Journal 103: 1773-1784
Fertilization

Courtesy Google Earth
Conclusions

1) Subsurface drip irrigation can be used to irrigate turf efficiently

2) also in combination with saline water

3) is a viable alternative to traditional sprinkler systems if installed, monitored, and maintained properly
Parking Lot Project
Filtration
Maintenance + Operation

![Image of a meter displaying gallons]
Success Stories
Athletic Fields
Athletic Fields
Rio Rancho – The Vision
Coaches Requirements

• Do it right
• Best playing surface – no artificial turf
• No sprinkler heads in playing areas
• Low mowing height
• Environmental and player friendly
Options Considered

Rehbein Environmental Solutions
EPIC System

Drip Line
Netafim or Toro DL2000
Decisions

- Drip line due to lower initial cost
- ‘Riviera’ bermudagrass – Drought tolerant, cold tolerant, low mowing height, salt tolerant, seeded
- Infrastructure for future improvements (conduit for future lighting, accommodate future reclaimed water connection)
- Balanced grading plan (no import or export of soil)
Germination and growth from 7/1/08 to 11/2/08
(Partial first growing season)
Fertilization

15 May 2010

31 May 2010
System Design

Information

1. Water quality
2. Pressure
   - preferably between 15 and 30 psi
3. Flow rate & pressure
   - important to determine maximum lateral length of drip lines
SUBSURFACE DRIP IRRIGATION (SDI)

Typical design:

- 4” (10 cm) depth
- 1’ (30 cm) spacing

Toro, 2000
SUBSURFACE DRIP IRRIGATION (SDI)
Supply line
Water meter
Pressure regulator
Header line
Control valve
System Design

Calculation of maximum lateral length:

- Supply flow rate \( S_f \): 20 gpm
- Emitter flow rate \( E_f \): 0.5 / 0.9 gph
- Emitter spacing \( E_s \): 12” / 18” / 24”

\[
MLL = \frac{S_f (gph)}{E_f (gph)} \cdot E_s (ft) = \frac{20 \cdot 60 \text{gph}}{0.5 \text{gph}} \cdot 1 \text{ft} = 2400 \text{ft}
\]
# Installation

## Length of Run Charts

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Flow Rate</th>
<th>Emitter Spacing</th>
<th>Inlet Pressure vs. Max Length of Run in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>15 psi</td>
</tr>
<tr>
<td>RPG212</td>
<td>0.53 gph</td>
<td>12&quot;</td>
<td>250'</td>
</tr>
<tr>
<td>RPG218</td>
<td>0.53 gph</td>
<td>18&quot;</td>
<td>350'</td>
</tr>
<tr>
<td>RPG224</td>
<td>0.53 gph</td>
<td>24&quot;</td>
<td>450'</td>
</tr>
<tr>
<td>RPG412</td>
<td>1.0 gph</td>
<td>12&quot;</td>
<td>160'</td>
</tr>
<tr>
<td>RPG418</td>
<td>1.0 gph</td>
<td>18&quot;</td>
<td>240'</td>
</tr>
<tr>
<td>RPG424</td>
<td>1.0 gph</td>
<td>24&quot;</td>
<td>300'</td>
</tr>
</tbody>
</table>
Emitter

DL2000 5/8\textsuperscript{th}
Emitter discharge rate vs. pressure

Flow rate (gph)

Pressure in psi

0.96
0.99
1.01
1.03
1.04
1.05
1.06
1.07
1.08
1.09

0.52
0.53
0.54
0.54
0.55
0.55
0.55
0.55
0.56
0.56

0.00
0.20
0.40
0.60
0.80
1.00
1.20

0.53 gph (2 lph)

1.02 gph (4 lph)
<table>
<thead>
<tr>
<th>Summary</th>
<th>Dos</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Do it right the first time (don’t use lowest bidder)</td>
<td></td>
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<tr>
<td>+ Use experienced contractor and a product that is specified for turf</td>
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<tr>
<td>+ Design (zoning) should follow soil test</td>
<td></td>
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<tr>
<td>+ Turtle back design</td>
<td></td>
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<tr>
<td>+ ONE filtration system for the entire system (preferably sand filter)</td>
<td></td>
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<tr>
<td>+ Grounds manager needs to be involved</td>
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<tr>
<td>+ Automatic AND manual flush valve for each zone</td>
<td></td>
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<tr>
<td>+ Fertilizer injection system</td>
<td></td>
</tr>
</tbody>
</table>
Summary

— Cut-rate installations
  (you get what you pay for)
— Cross connections
— Crowning
— One filter for each zone (valve)

Don’ts