Organic Amendments Improve Tall Fescue Growth in Urban Soils

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What is an Urban Soil?

- **Urban soil**: material that has been manipulated, disturbed or transported by human activities.

- Physical, chemical, and biological properties differ significantly from their “natural” counterparts.
Major Problems with Urban Soil

• COMPACTION!
  – Altered and/or degraded soil structure reduces rooting, aeration, and water infiltration

• Little to no soil organic matter
  – Reduced water-holding capacity, nutrient holding capacity availability and soil structure
Biosolids use in Urban Soils

• Improving urban soil properties can be done with the use of Exceptional Quality (EQ) biosolids produced by waste water treatment plants (WWTP)

• EQ biosolids can be applied to public access areas.

• EQ biosolids improve vegetation establishment by supplying nutrients and organic matter
Objectives

• To compare various EQ biosolids and an inorganic fertilizer under two irrigation regimes on a simulated post-development soil

• Comparing
  – (i) soil physical and chemical properties of an urban disturbed soil
  – (ii) quality and persistence of tall fescue turfgrass
Site Preparation

0, E, and A Horizons removed exposing underlying subsoil

Irrigation system layout and installation
Amendments (Target Rate: 224 kg N ha$^{-1}$)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>C:N</th>
<th>Loading Rate</th>
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<tbody>
<tr>
<td>Fertilizer only (Control)</td>
<td></td>
<td>200 lbs N/ ac</td>
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<tr>
<td>Alexandria Dewatered Biosolids (Alex-DB)</td>
<td>7:1</td>
<td>4.9 tons/ac (Wet)</td>
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<tr>
<td>Alexandria Blend (Alex-N)</td>
<td></td>
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<tr>
<td>50% Biosolids/25% Sand/25% Sawdust Agronomic N-Rate</td>
<td>15:1</td>
<td>70.6 tons/ac (Wet)</td>
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<tr>
<td>Alexandria Blend (Alex-P)</td>
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<td></td>
</tr>
<tr>
<td>50% Biosolids/25% Sand/25% Sawdust Agronomic P Rate</td>
<td>15:1</td>
<td>20.2 tons/ac (Wet)</td>
</tr>
<tr>
<td>Spotsylvania Biosolids Compost (Spots)</td>
<td>13:1</td>
<td>54.3 tons/ac (Wet)</td>
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*Urea (46-0-0) was incorporated as the primary nitrogen source while Promate (25-5-11) was used for follow up applications to the control and Alex-P amendments.*
Amendment Application and Tall Fescue Establishment

Amendments applied Sept. 12, 2013
Tilled to depth of 4 in. following application
Tall fescue seeded, Sept. 13, 2013
Measurements

• Volumetric soil moisture percentage

• Clipping yield biomass
  – Subsample collected to estimate leaf nitrogen uptake

• Normalized Difference Vegetative Index (NDVI) “greenness”

• Visual ratings of color and quality

How NDVI is measured
Establishment Phase March 2014

Alex-DW

Control

SPOTS
Drought Phase June 2014
September 2015

Arrow = Control (fertilizer) plots
Residual Year: April 2016
Arrow = Control (fertilizer) plots
Results from 2013-2014

• Results from 2013-2014 depended heavily on nitrogen availability

• Control inorganic fertilizer outperformed all biosolids treatments in turfgrass quality and biomass.
  – Plant Available Nitrogen loading rates were overestimated due to lower than expected mineralization rates for all of the biosolids amendments

• Loading rates for 2015-2016 were increased and split applications to narrow the gap between the inorganic and organic amendments
Results 2015

• September 2014-August 2015, all nutrient sources were split applied throughout the year

• Biosolids products performed as well or better than the fertilizer during this period in turfgrass biomass and quality
  – Likely due to residual effects of the organic products and greater N use efficiency due to split applications
  – Performance: Spots (Compost) > Dewatered > Sand/Sawdust N Rate > Sand/ Sawdust P Rate > Synthetic Fertilizer (Control)
Questions?