Analysis of Bacteroides qPCR Utility for Estimating Bacterial Loading from Cattle

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Objectives

- **Our challenge:**
  - Accurately assessing contributions from various sources

- **Study objectives:**
  - Assess ability of BoBac marker to assess quantity of *E. coli* loading from cattle
  - Evaluate relationship between AllBac & *E. coli*
Methods

• Edge-of-field runoff collected over two years at seven grazing management sites

• Samples analyzed for:
  – *E. coli* - EPA Method 1603
  – *Bacteroides* (Layton et al., 2006)
    • Total *Bacteroides* spp. (AllBac)
    • Bovine-associated *Bacteroides* spp. (BoBac)
<table>
<thead>
<tr>
<th>Site-Yr&lt;sup&gt;1&lt;/sup&gt;</th>
<th>AllBac Median</th>
<th>BoBac Median</th>
<th>Grazing Management</th>
<th>Annual AUD/ha</th>
<th>Cattle on site during runoff-%&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beef Cattle Systems Center</strong></td>
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<td></td>
</tr>
<tr>
<td>BB1-09</td>
<td>9.49E+06</td>
<td>6.18E+03</td>
<td>Ungrazed</td>
<td>0</td>
<td>No-0%</td>
</tr>
<tr>
<td>BB2-09</td>
<td>4.30E+06</td>
<td>4.59E+03</td>
<td>Properly stocked</td>
<td>147</td>
<td>No-0%</td>
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<tr>
<td>BB3-09</td>
<td>3.30E+06</td>
<td>6.13E+03</td>
<td>Overstocked</td>
<td>312</td>
<td>No-0%</td>
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<tr>
<td>BB1-10</td>
<td>3.58E+06</td>
<td>1.12E+05</td>
<td>Ungrazed</td>
<td>17</td>
<td>Yes&lt;sup&gt;3&lt;/sup&gt;-20%</td>
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<tr>
<td>BB2-10</td>
<td>4.74E+06</td>
<td>8.87E+05</td>
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<td>301</td>
<td>Yes-67%</td>
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<tr>
<td>BB3-10</td>
<td>1.45E+07</td>
<td>2.90E+06</td>
<td>Overstocked</td>
<td>543</td>
<td>Yes-75%</td>
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<td><strong>USDA-ARS Riesel watersheds</strong></td>
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<tr>
<td>SW12-08</td>
<td>7.61E+06</td>
<td>1.51E+03</td>
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<td>0</td>
<td>No-0%</td>
</tr>
<tr>
<td>SW17-08</td>
<td>5.22E+07</td>
<td>5.45E+06</td>
<td>Properly stocked</td>
<td>124</td>
<td>Yes-100%</td>
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<tr>
<td>SW12-09</td>
<td>4.18E+06</td>
<td>2.17E+03</td>
<td>Ungrazed</td>
<td>0</td>
<td>No-0%</td>
</tr>
<tr>
<td>SW17-09</td>
<td>1.58E+07</td>
<td>6.95E+06</td>
<td>Properly stocked</td>
<td>341</td>
<td>Yes-100%</td>
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<td><strong>Welder Wildlife Refuge</strong></td>
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<tr>
<td>WWR1-10</td>
<td>2.74E+06</td>
<td>7.93E+04</td>
<td>Ungrazed</td>
<td>0</td>
<td>No-0%</td>
</tr>
<tr>
<td>WWR3-10</td>
<td>6.99E+05</td>
<td>1.73E+04</td>
<td>Properly stocked&lt;sup&gt;4&lt;/sup&gt;</td>
<td>0</td>
<td>No-0%</td>
</tr>
</tbody>
</table>
A. BCSC AllBac

BB1 $R^2=0.31$, $p=0.04$
BB2 $R^2=0.43$, $p<0.01$
BB3 $R^2=0.42$, $p<0.01$

B. Riesel AllBac

SW12 $R^2=0.00$, $p=0.89$
SW17 $R^2=0.00$, $p=0.92$

C. BCSC BoBac

BB1 $R^2=0.29$, $p=0.05$
BB2 $R^2=0.01$, $p=0.67$
BB3 $R^2=0.33$, $p<0.01$

D. BCSC BoBac

BB1 $R^2=0.29$, $p=0.05$
BB2 $R^2=0.01$, $p=0.67$
BB3 $R^2=0.33$, $p<0.01$

E. Riesel BoBac

SW12 $R^2=0.04$, $p=0.39$
SW17 $R^2=0.00$, $p=0.89$
AllBac ($r^2=0.79$, $p < 0.001$)
BoBac ($r^2=0.75$, $p = 0.001$)
Grazing Management Evaluation Summary

- Both markers higher in runoff while sites stocked suggesting they provide good indicator of recent fecal contamination from cattle.

- BoBac/AllBac ratios generally aligned with stocking rate but may have underestimated percentage of bovine-associated fecal contamination.

- Differing results in various watersheds
  - Geographic variability markers?
  - Markers correlated well with *E. coli* at one location
  - Standard curve
Questions?

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http://grazinglands-wq.tamu.edu/index.php

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