MANAGEMENT OF MANURES IN CORN AND SORGHUM

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Testing
Soil and Manure

Crop Selection
Corn or Sorghum Variety

Management
Water Cultural
What Do I Have to Work With?

• Evaluate the Soil
  – Salinity
    • Limitations Crop Performance
    • Impacts Irrigation Water Management
    • Impacts Crop Choice
    • Methods Matter
Salinity

1:1 vs Saturated Paste
Salinity Measures

![Graph showing the relationship between Saturated Paste and 1:1 (mmhos/cm). The data points are scattered around the 1:1 Relationship Line.]
Predicting $E_{Ce}$ from $E_{C_{1:1}}$

$$E_{Ce} = 2.14(E_{C_{1:1}}) + 0.00187(Na)$$

adjusted $R^2=0.9373$
Yield/Performance as a function of EC

Threshold

Slope

EC (mmhos cm^{-1})

Yield/Performance as a function of \( EC_e \)
### Soil Test $EC_e = 4.0$ mmhos/cm

<table>
<thead>
<tr>
<th>Crop</th>
<th>Threshold</th>
<th>Slope</th>
<th>EC Difference</th>
<th>Yield Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corn</strong></td>
<td>1.7 mmhos/cm</td>
<td>12%</td>
<td>4.0 - 1.7 = 2.3</td>
<td>28% yield loss</td>
</tr>
<tr>
<td><strong>Sorghum</strong></td>
<td>6.8 mmhos/cm</td>
<td>16%</td>
<td>4.0 - 6.8 = no effect on yield</td>
<td>Yield Potential Maintained</td>
</tr>
</tbody>
</table>

- 30 T/A becomes 22 T/A

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**Note:** The yield loss percentage is calculated by multiplying the different EC by the slope percentage.
Crop Tolerance
- Corn Variety Choices?
  - No
- Sorghum is moderately tolerant
- Alfalfa Variety Choices
  - Yes

Leaching
- Determined in conjunction with irrigation water salinity $E_{cw}$
- Caution – Risk of losing Nitrate-N with depth
How much Soil Nitrate?

• Excessive Soil Nitrate
• NM Regulatory Concerns
  – Don’t want nitrates below effective root zone
  – Must account for N in profile
  – N removal tracked
• Corn and Sorghum can accumulate NO$_3$
Deep Rooting

No Effluent or Manure

Alfalfa Field

Corn No Manure
Nitrate-N with Depth

**ppm NO$_3$-N**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Manure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12</td>
<td></td>
</tr>
<tr>
<td>12-24</td>
<td></td>
</tr>
<tr>
<td>24-36</td>
<td></td>
</tr>
<tr>
<td>36-48</td>
<td></td>
</tr>
<tr>
<td>48-60</td>
<td></td>
</tr>
<tr>
<td>60-72</td>
<td></td>
</tr>
<tr>
<td>72-84</td>
<td></td>
</tr>
</tbody>
</table>

**Sprinkler Irrigated**

**With Effluent or Manure**
What Do I Have to Work With?

• Manure Testing
  – C:N Ratio
  – %N
  – Other Nutrients
  – Total Salts
From a sampling of 72 dairies

<table>
<thead>
<tr>
<th></th>
<th>lb/Ton</th>
<th></th>
<th>lb/Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total N</td>
<td>42</td>
<td>Total Salt</td>
<td>51</td>
</tr>
<tr>
<td>P$_2$O$_5$</td>
<td>27</td>
<td>Na</td>
<td>8</td>
</tr>
<tr>
<td>K$_2$O</td>
<td>56</td>
<td>Ca</td>
<td>64</td>
</tr>
</tbody>
</table>

C/N 15
Why C/N Carbon?

- Verify C:N Ratio
- Season = 125 days
  - 2200 GDD (32°F base)
- §: Chicken Composts similar to uncomposted 4% N material

<table>
<thead>
<tr>
<th>% DW</th>
<th>C/N</th>
<th>PAN† (% of Total N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>28 d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uncomposted Materials</td>
</tr>
<tr>
<td>1</td>
<td>35</td>
<td>&lt;0</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>45</td>
</tr>
<tr>
<td>6</td>
<td>&lt;6</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>&lt;6</td>
<td>60</td>
</tr>
<tr>
<td>8+</td>
<td>&lt;6</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Composts§</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>2-3</td>
<td>10-15</td>
<td>5</td>
</tr>
</tbody>
</table>

†OSU
Predicting N for Corn or Sorghum

• Use C:N Ratio
• Evaluate P loading
  – May be too much when based solely on N
• Westermann et al., (2005) Available P (Olsen)
  – Fertilizer P > liquid P > solid or composted P
• Check if limitations based on P-index
• Annual Soil Test
Manure as a N Source for Corn or Sorghum

• For every dry ton of dairy manure
  – 42 lb total N
  – 6.3 lb N Actually available
    • Don’t pile it on
    • Rest carries over
    • Do new Soil Test
Manure for N at PAN

**Corn**
- Max: 51 dry tons
- Min: 26
- Ave: 37

**Sorghum**
- Max: 39 dry tons
- Min: 20
- Ave: 31
Soil Micronutrients - Cu

Every 13 dry T/Acre = 1 lb Cu/Acre
Crop Selection
Corn or Sorghum
Role of Variety
Trials
Yield Trials

Corn for Silage Yield

Ton/Acre (35% Dry Matter Basis)

Variety (2011)

- Artesia
- Clovis
- Farmington
Corn
Sorghum
15,000 Ton Purchase Agreement

• Top 3 Corn Varieties Average 27.2 T/A
  – Need 565 Acres
  – 57.05 million lb milk

• Bottom 3 Corn Varieties Average 23 T/A
  – Need 658 Acres
  – 48.14 million lb milk

• Short 94 acres

• Short 8.91 million lb milk

• Makeup with rolled corn?
15,000 Ton Purchase Agreement

• Top 3 Sorghum Varieties Average 32.5 T/A
  – Need 463 Acres
  – 47.95 million lb milk

• Bottom 3 Sorghum Average 15.3 T/A
  – Need 994 Acres
  – 51.355 million lb milk

• Need 531 more acres for bottom 3
N Removal – NMED Requirement

<table>
<thead>
<tr>
<th>Crop</th>
<th>Max: 322 lb N/Ac</th>
<th>Min: 166 lb N/Ac</th>
<th>Ave: 232 lb N/Ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>Max: 247 lb N/Ac</td>
<td>Min: 126 lb N/Ac</td>
<td>Ave: 198 lb N/Ac</td>
</tr>
</tbody>
</table>
Rooting Depth

Corn
- Shallow
- 1.5-2 ft

Sorghum
- Deeper
- 3-5 ft
Be Mindful of Where the Nitrate is

With Effluent or Manure
<table>
<thead>
<tr>
<th>Crop</th>
<th>Rule 1.25</th>
<th>PAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>10 Ton/Ac</td>
<td>51 Ton/Ac</td>
</tr>
<tr>
<td>Sorghum</td>
<td>8 Ton/Ac</td>
<td>39 Ton/Ac</td>
</tr>
</tbody>
</table>
Follow BMPs for Corn and Sorghum

- Pre-sidedress soil nitrate test
- Sufficient nutrition during logarithmic stage of growth.
- Evaluate nitrate-N after season
- Ensiling will help lower NO$_3$-N in either crop prior to feeding
What's Wrong Here? Soil? Water? Insects?

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