CORN RESPONSE TO DRIP IRRIGATION

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Why Drip Irrigation for Corn?

• It works!
• Conserve water
• Use existing drip system (crop rotation)
• Automation
• Fertigation
• Weed and disease control
Conserve Water by Minimizing Water Losses

• Runoff
• Evaporation
• Drainage
Irrigation Efficiency

- Furrow Irrigation: 40-60%
- Sprinkler Irrigation:
  - Siderolls: 60-80%
  - Center Pivots: 70-95%
- Subsurface Drip Irrigation: 90-100%
Concerns!

- Cost
- Arkansas River Compact
- Water supply
- Salinity
- Maintenance
Typical SDI Configuration

http://www.oznet.ksu.edu/sdi/
8-in. depth
60-in. spacing
Precipitation Amounts (gross)

![Bar chart showing precipitation amounts for different categories: SDI-FI, Frl-FI, SDI-DI, Frl-DI, and Rain, with data for 2005, 2006, and 2007. The chart displays the inches of precipitation for each category.]
Corn Yield: Drip vs. Furrow Irrigation

<table>
<thead>
<tr>
<th>Year</th>
<th>SDI</th>
<th>FrI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>200</td>
<td>220</td>
</tr>
<tr>
<td>2006</td>
<td>220</td>
<td>240</td>
</tr>
<tr>
<td>2007</td>
<td>200</td>
<td>180</td>
</tr>
</tbody>
</table>
Corn Yield: Full vs Deficit Irrigation

<table>
<thead>
<tr>
<th>Year</th>
<th>Full (FI)</th>
<th>Deficit (DI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>210</td>
<td>190</td>
</tr>
<tr>
<td>2006</td>
<td>230</td>
<td>200</td>
</tr>
<tr>
<td>2007</td>
<td>210</td>
<td>190</td>
</tr>
<tr>
<td>Cropping Season</td>
<td>Nitrogen Fertilizer</td>
<td>Manure</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>2005</td>
<td>YES (March’05)</td>
<td>YES (March’05)</td>
</tr>
<tr>
<td>2006</td>
<td>YES (March ’06)</td>
<td>YES (Nov.’05)</td>
</tr>
<tr>
<td>2007</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>
Corn yield as affected by N and manure rates in 2007

LSD$_{0.05}$: 20 bu/a
Soil Nitrate-N in the Spring and Fall 2007
Post harvest soil P in 0-1 ft in 2005-2007
**ECe as affected by irrigation type and sampling position and depth in Nov’06**

<table>
<thead>
<tr>
<th>Depth</th>
<th>SDI (dS/m)</th>
<th>FrI (dS/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Furrow</td>
<td>Row</td>
</tr>
<tr>
<td>0-6”</td>
<td>1.1</td>
<td>1.3</td>
</tr>
<tr>
<td>6-12”</td>
<td>1.4</td>
<td>1.6</td>
</tr>
<tr>
<td>1-2’</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>2-3’</td>
<td>2.7</td>
<td>3.0</td>
</tr>
<tr>
<td>3-4’</td>
<td>2.9</td>
<td>3.9</td>
</tr>
<tr>
<td>4-5’</td>
<td>4.0</td>
<td>4.8</td>
</tr>
<tr>
<td>5-6’</td>
<td>4.1</td>
<td>4.7</td>
</tr>
</tbody>
</table>
### ECe as affected by irrigation type and sampling position and depth in Oct’07

<table>
<thead>
<tr>
<th>Depth</th>
<th>SDI (dS/m)</th>
<th>FrI (dS/m)</th>
</tr>
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<tr>
<td></td>
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<td>5.2</td>
</tr>
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<td>3.8</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Soil ECe of SDI and FrI in Nov’06

Soil ECe (dS/m)

Soil Depth (ft)

SDI
FrI

0.5 1.0 2.0 3.0 4.0 5.0 6.0
Soil ECe of SDI and FrI in Oct’07

Soil ECe (dS/m)

Soil Depth (ft)

SDI
FrI
Irrigation Scheduling Experiment

![Graph showing the relationship between lb N/acre and bu/acre. The graph has two columns, one for 120 lb N/acre with a bu/acre value of 215 and another for 240 lb N/acre with a bu/acre value of 212.]
Irrigation Scheduling Experiment

![Graph showing irrigation treatment (ETc) vs. yield (bu/acre)]

- **Irrigation Treatment (%ETc):** 50, 75, 100, 125
- **Bu/acre:**
  - 50: 191c
  - 75: 206bc
  - 100: 221ab
  - 125: 235a
Cumulative ETc and PP in Fr1
Corn Response to SDI in Colby, KS

\[ \text{Relative corn yield} = 0.53 + 0.825 \text{FFI} - 0.377 \text{FFI}^2 \]

\[ \text{RSQUARE} = 0.49 \quad \text{SE} = 0.15 \]

- SDI Fertilizer, 1990-1991 (Standard Fertilizer Tlt)
- SDI Irrigation Capacity, 1996-2001 (Hi Population Tlt)
- SDI Frequency, 2002-2004 (Hi Population Tlt)

http://www.oznet.ksu.edu/sdi/
The results of SDI studies in 1989-2004 in Colby, KS show that relative corn yield reached a plateau at about 80% of full irrigation.

http://www.oznet.ksu.edu/sdi/
Conserve Water

• Minimize water losses
  – Runoff
  – Evaporation
  – Drainage
7% percolation reduction at 75% of Irrigation!

SDI Corn, Colby, KS. 1989-91.

AET
Drainage
Irrigation

http://www.oznet.ksu.edu/sdi/
Alfalfa Response to SDI
Yellow Jacket, 2002&2003

\[ Y = -0.004X^2 + 0.37X - 1.40 \]

\[ R^2 = 0.84 \]
Take Home Message

• SDI = FrI with ~43% less water
• Additional savings (20-30%) with sound irrigation scheduling (Targeted irrigation)
• N rate ↔ Soil test results & Yield goal
• Challenges with SDI
  – Salt accumulation
  – Seed germination
Thank You!