Strategies to Improve Soil Condition in Semi-Arid Cropping Systems

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Texas Rolling Plains

- Rainfall
  - 46 to 76 cm; 56 to 66 cm

- Monoculture Cropping Systems
  - Cotton
  - Wheat (graze and grain)

- <15% of crop acres irrigated = >43% cash receipts
Strategies to Improve Soil Condition

- Soil Health
  - How healthy are our soils? How healthy can soils be?
- Water is limiting factor for crop production in semi-arid systems
- Retain precipitation and reduce evaporation
- Conservation Tillage
  - It has been estimated that 16% of cropped acres in Texas are under conservation tillage.
- Intensified Cropping Systems
  - Crop Rotation, high residue crops
  - Cover Crops, soil moisture concerns?
## Soil Organic Carbon

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Dryland (Clay Loam)</th>
<th>Irrigated (Sandy Loam)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CT</td>
<td>NT</td>
</tr>
<tr>
<td>Organic C (ppm)</td>
<td>Total C (ppm)</td>
<td></td>
</tr>
<tr>
<td>0-10</td>
<td>6637</td>
<td>8820</td>
</tr>
<tr>
<td>10-20</td>
<td>6559</td>
<td>8480</td>
</tr>
<tr>
<td>20-30</td>
<td>7044</td>
<td>9087</td>
</tr>
<tr>
<td>30-60</td>
<td>6595</td>
<td>8422</td>
</tr>
</tbody>
</table>

8 yr No-Till continuous wheat; CT - dryland = continuous cotton; Irrigated = cotton/peanut rotation
## Continuous Cotton Systems

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Organic C (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>ST</td>
</tr>
<tr>
<td>0-10</td>
<td>8476</td>
</tr>
<tr>
<td>10-20</td>
<td>6472</td>
</tr>
<tr>
<td>20-30</td>
<td>6103</td>
</tr>
<tr>
<td>30-60</td>
<td>5688</td>
</tr>
<tr>
<td>60-90</td>
<td>6516</td>
</tr>
</tbody>
</table>

Conventional

No-Till Since 2008

No-Till
Soil Health Assessment – Haney Test

Water Extractable Organic C (mg/kg)

- Red: Continuous Cotton
- Blue: Cotton/Sorghum

<table>
<thead>
<tr>
<th>Method</th>
<th>Water Extractable Organic C (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conv. Till</td>
<td>120</td>
</tr>
<tr>
<td>Strip-Till</td>
<td>130</td>
</tr>
<tr>
<td>No-Till</td>
<td>150</td>
</tr>
<tr>
<td>No-Till Cover</td>
<td>150</td>
</tr>
</tbody>
</table>
Physical Properties

- **Infiltration (in/min)**
  - **Time 1:**
    - Conv.: 0.1
    - Strip: 0.1
    - No-Till: 0.1
    - NT-Cover: 0.1
  - **Time 2:**
    - Conv.: 0.1
    - Strip: 0.1
    - No-Till: 0.1
    - NT-Cover: 0.1

- **Penetration Resistance (Kpa/cm)**

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**Graphs showing penetration resistance and infiltration rates for different treatments.**
2013 Stored Soil Water in Top 140 cm

- Conv. Till
- Mixed Cover
- No. Till
- Wheat

- 1.3 cm irrigation 5/31
- 1.0 cm irrigation 6/4
- 6.9 cm precipitation 6/6
- 1.8 cm precipitation 6/8

Cover Termination
GOAL

20% increase in water capture by soil by 2030