What is Canola Doing to the Soil? Surface Crusting and Sub-soil Effects

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Introduction

• Soil crusting can affect soil and crop quality in multiple ways including:
  – Reduce water infiltration
    (Van Winkel & Morin, 1996; Zuzel & Pikul, 1994)
  – Enhance water runoff and erosion
    (Ben-Hur & Wakindiki, 2002; Remley & Bradford, 1989)
  – Negatively impacting seed emergence
    (Schillinger, 2011; Guerif et al., 2001)
Introduction

Formation of structural crusts
(Valentin & Bresson 1992)

Detachment

Drying & high temps

SiO₂

pH

%moisture  %OM

Soil type
Introduction

• Why should we be concerned with Si?
  – High Si has been linked to pan formation increasing mechanical resistance to roots, impairing drainage, and reducing plant production (Brown and Mahler, 1987)
  – $\text{Si}_\text{am}$ can adsorb onto soil particles causing pore radius to shrink
Differences in Si accumulation has been attributed to uptake ability of the roots.

Ma & Yamaji, 2006
Hypothesis?

- Canola may reduce the risk of crusting due to lower levels of Si in the residue

- Greenhouse Study

- Soil Incubation

[Images of plants and soil samples]
Average Si Accumulated

- **Canola**
- **Wheat**

<table>
<thead>
<tr>
<th>Fertilizer Rate (g N/kg soil)</th>
<th>Canola</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.01</td>
<td>0.05</td>
</tr>
<tr>
<td>60</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>180</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>420</td>
<td>0.04</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Average Soil $Si_{am}$

- Blue bars represent Canola Rotation.
- Aqua bars represent Wheat Rotation.

**Si$_{am}$ (g/kg soil)**

- X-axis: $SiO_2$ (g/kg soil)
- Y-axis: $Si_{am}$ (g/kg soil)

The graph shows the average soil $Si_{am}$ for different $SiO_2$ concentrations in both Canola and Wheat Rotations. The concentrations range from 0 to 2 g/kg soil.
Average Crust Thickness

- **Crust Thickness (mm)**
- **SiO₂ (g/kg soil)**

**Graph:**
- **Canola Rotation**
- **Wheat Rotation**

- Crust thickness increases with SiO₂ concentration.
- The trend is consistent across both rotation types.
What about in the real world?

<table>
<thead>
<tr>
<th>Depth</th>
<th>WW/B/SW (g Si/kg soil)</th>
<th>WW/C/B (g Si/kg soil)</th>
<th>C/WW/B (g Si/kg soil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4”</td>
<td>43.5 a</td>
<td>31.6 ba</td>
<td>26.8 ba</td>
</tr>
<tr>
<td>4-8”</td>
<td>17.8 ba</td>
<td>13.2 ba</td>
<td>28.4 ba</td>
</tr>
<tr>
<td>8-12”</td>
<td>19.2 ba</td>
<td>8.6 b</td>
<td>23.7 ba</td>
</tr>
</tbody>
</table>

* Preliminary data only taken once
What is Canola Doing to the Soil?

• Contributing less Si to the soil pool

• Less Si can lead to less surface crusting and less sub-soil compaction

• Canola roots may help break up the lower pan allowing Si to cycle to lower layers within the soil
Questions ?