Does preceding crop affect corn growth and grain yield in Manitoba?

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Introduction
- Corn (Zea mays) acreage in Manitoba, Canada, increased by 30% in 2016 from 2015 to 131,500 ha and ranks fourth in production after wheat, canola and soybean (Stat Canada, 2016).
- Corn grain yield is affected by early phosphorus (P) absorption; between planting and V6 stage (Grant et al., 2001).
- Early P absorption is strongly dependent on timing of arbuscular mycorrhizal fungi (AMF) colonization in corn (Barry and Miller, 1989).
- Early AMF colonization on corn roots depend upon the mycorrhizal dependency of the preceding crop (Plenchette et al., 2005).
- Mycorrhizal dependent crops (soybean, corn, wheat, flax) can increase AMF populations in soil; non-mycorrhizal crops (canola, spinach) may decrease/delay AMF population in soil.

Objective
- To determine the best crop to grow prior to corn and to determine the influence of preceding crop on:
  1. Corn growth
  2. AMF colonization of corn roots
  3. Corn grain yield

Material and Methods
- A two-year crop sequence study was initiated in 2014-15 at University of Manitoba research station, Carman (49°29’53”N; 98°01’47”W), MB, Canada.
- Analysis prior to the study showed that the soil had a pH of 5.0 and Olsen-P of 34 ppm

Treatments
- Preceding (1st year) crop: (Figure 1)
  - Canola, Corn, Soybean, Wheat
- Test (2nd year) crop: Corn

Results
- Figure 2: Effect of preceding crop on dry matter yield at (A) V6 and (B) silking stages of the corn test crop at Carman, 2015.
- Figure 3: Effect of preceding crop on P uptake at (A) V6 and (B) silking stages of the corn test crop at Carman, 2015.
- Figure 4: Effect of preceding crop on (A) test weight and (B) grain yield of corn test crop at Carman, 2015.

Table 1: Effect of preceding crop on the arbuscular mycorrhizal fungi (AMF) colonization of corn roots at V6 and silking stages of the corn test crop at Carman, 2015

<table>
<thead>
<tr>
<th>Preceding Crop</th>
<th>Arbuscular Mycorrhizal Fungi Colonization</th>
<th>%</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Hyphae</td>
<td>Arbuscles</td>
<td>V6 stage</td>
<td>Silking stage</td>
</tr>
<tr>
<td>Canola</td>
<td>44.5</td>
<td>52.9</td>
<td>25.2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>41.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>24.7</td>
</tr>
<tr>
<td>Corn</td>
<td>53.8</td>
<td>55.7</td>
<td>39.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>45.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>24.2</td>
</tr>
<tr>
<td>Soybean</td>
<td>51.9</td>
<td>47.4</td>
<td>35.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>36.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>24.6</td>
</tr>
<tr>
<td>Wheat</td>
<td>56.6</td>
<td>52.4</td>
<td>31.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>38.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>32.6</td>
</tr>
<tr>
<td>Pr&gt;F</td>
<td>NS&lt;sup&gt;a&lt;/sup&gt;</td>
<td>NS</td>
<td>0.0207</td>
<td>0.041</td>
<td>NS</td>
</tr>
<tr>
<td>Contrasts:</td>
<td>Canola vs all other preceding crops</td>
<td>0.029</td>
<td>0.689</td>
<td>0.008</td>
<td>0.753</td>
</tr>
</tbody>
</table>

* means followed by different letters in columns are significantly different (P<0.05): # NS, not significant (P>0.05); Contrast statement was used to compare effect of preceding canola crop on AMF colonization on corn roots compared to all other preceding crops in the study.

Key findings
- Dry matter yield of corn and plant P uptake was affected by the preceding crop at V6 as well as silking stage.
- Soybean—corn sequence showed highest dry matter yield and P uptake at V6 as well as silking stage followed by corn-corn and soybean-corn sequences.
- In canola-corn sequence, P uptake was lowest at V6 stage but similar to soybean-corn sequence at silking stage.
- Lower hyphal colonization in the canola-corn sequence was observed at the V6 stage compared to other crop sequences (Table 1). There were no differences in total colonization between treatments.
- Preceding crop did not influence the corn grain yield or corn test weight in the first year of this study (Figure 3).
- These results are being validated in 2015-16 and 2016-17.

References

Acknowledgements