Evaluating Cover Crops Effects on Soil Organic Matter and its Fractions

By Zoe Heuermann
Soil Organic Matter (SOM)

- SOM is measured as an important indicator of soil health
- Changes in SOM take years to manifest
- Thus, scientists measure the more sensitive fractions of SOM

http://www.treepower.org/soils/soilorganicmatter.html
Wheat-Fallow Cropping System

- Continued use of fallow depletes SOM

- Figure: Soil organic carbon depletion over the course of 79 years under a what-fallow system at the Columbia Basin Agricultural Research Station near Pendleton, OR

![Graph showing Soil Organic Carbon (ton/ac) over years from 1931 to 2010.](Adapted from Machado 2011 and Ghimire et al., 2015)
Purpose of the Experiment: To determine...

- Effects of cover crops on SOM buildup
- SOM fractions sensitive to SOM dynamics under different cover crop treatments
- Trends between depths and the SOM fractions
- Correlations between SOM fractions
Wheat-Cover Cropping System

- Summer 2014 at the Columbia Basin Agricultural Research Station near Pendleton, OR
- 30 plots (90x20 ft) under no tillage
- Loam type soil

### Experimental Design

<table>
<thead>
<tr>
<th>Main Treatment</th>
<th>Plots</th>
<th>Sub Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover Crop</td>
<td>1</td>
<td>Fallow</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Pea</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Mix</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Barley</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Mustard</td>
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<tr>
<td></td>
<td>6</td>
<td>Mustard</td>
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<tr>
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<td>7</td>
<td>Mix</td>
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<tr>
<td></td>
<td>8</td>
<td>Barley</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Pea</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Fallow</td>
</tr>
</tbody>
</table>
Wheat-Cover Cropping System

- Soil samples (0-10 cm and 10-20 cm) were collected on June 20th and 21st, 2017
- Air-dried and passed through 2 mm sieve
- Measured general soil health parameters and SOM fractions
Effects of Cover Crop Treatments on SOM and its Fractions

- No significant differences found in SOM and its fractions between the cover crop treatments.

The Effect of Cover Crop Treatments on Particulate Organic Carbon

The Effect of Cover Crop Treatments on Soil Active Carbon
Trends between Soil Depths

- The upper depth (0-10cm) has more organic matter than the lower depth (10-20cm).
- No consistent trends between depths and treatments in the measured fractions.
- Important to sample at different soil depths.
# Correlations between SOM Fractions (0-10 cm)

<table>
<thead>
<tr>
<th></th>
<th>Soil Organic Carbon</th>
<th>Total Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Organic C</td>
<td>0.74***</td>
<td>0.65***</td>
</tr>
<tr>
<td>Particulate Organic N</td>
<td>0.62***</td>
<td>0.55**</td>
</tr>
<tr>
<td>Mineralizable C</td>
<td>0.80***</td>
<td>0.63***</td>
</tr>
<tr>
<td>Active/Oxidizable C</td>
<td>0.14ns</td>
<td>0.19ns</td>
</tr>
</tbody>
</table>

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001; ns = not significant

Values represent Pearson’s r value
Conclusions

- No differences in SOM and its fractions among cover crop treatments
- There is more SOM in the 0-10 cm depth than 10-20 cm depth
  - Sample soils at different depths
- Highly significant correlations between SOM fractions
  - Mineralizable carbon and Particulate organic carbon
  - More sensitive fractions can estimate less sensitive fractions
- More SOM fractions to measure
  - Inorganic N and Microbial Biomass
Extension Product

- Informative poster explaining SOM and its fractions
- Definitions
- Applications while considering accessibility
- Sources for more information about SOM
- Audience:
  - Agricultural scientists
  - Growers in the PNW
  - Environmentalists and policy makers
Thank you!

- Special thanks to Rakesh Awale, Stephen Machado, the USDA, the REACCH sponsors and interns, Rodney Miller, Larry Pritchett, Daisy, and Debbie Sutor for all the support and help!

- This work was supported by the National Institute of Food and Agriculture (NIFA), USDA Award Number: 2016-67032-25012