Soil Test P vs. Total P in Wisconsin Soils

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Introduction

• Soil test P is often measured
• Little information is available on total P content of soils
• Why do we care about total P now?
  - Soil total P is a necessary input for the P-index
  - P-index is one option for P-based nutrient management planning
  - Total P is needed to estimate the particulate P component of the P index
Components of the Phosphorus Index (PI):

\[ \text{PI} = \text{PP} + \text{SP} \]

\[ \text{PI} = \text{Total P index} \]

\[ \text{PP} = \text{Particulate P} \]

\[ \text{SP} = \text{Soluble P} \]
Introduction

• Total P analysis is too time consuming and expensive for routine soil testing.

• Interest in predicting total P from readily available info., such as soil test P.
# Book Values for Soil Total P

<table>
<thead>
<tr>
<th>Source</th>
<th>Total soil P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Havlin et al., 1999</td>
<td>0.005-0.15</td>
</tr>
<tr>
<td>Schulte &amp; Walsh, 1998</td>
<td>0.10</td>
</tr>
<tr>
<td>Troeh &amp; Thompson, 1993</td>
<td>0.035-0.25</td>
</tr>
</tbody>
</table>
Soil P-Total P Comparison

• Total P and Bray soil test P measured on 90 agricultural soil samples selected to represent major soil groups and for geographic distribution.
  - Wisconsin Soil and Plant Analysis Laboratory
  - Bray P-1, and soil total P
  - Other routine tests performed (eg., soil organic matter)
Soil Total P

Northern loamy soils
avg = 540 ppm
range = 480-580 ppm
n = 4

Southern forest soils
avg = 600 ppm
range = 350 - 1400 ppm
n = 43

Southern prairie soils
avg = 700 ppm
range = 380 - 1300 ppm
n = 27

Eastern red soils
avg = 950 ppm
range = 430 - 2820 ppm
n = 12

Sandy soils
range = 250 - 400 ppm
n = 2

Organic soils: range = 1330 - 1350 ppm, n = 2
### Total Phosphorus Content of Wisconsin Soils

<table>
<thead>
<tr>
<th>Soil group</th>
<th>No.</th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Forest soils</td>
<td>43</td>
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<td>Organic soils</td>
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<td>1330-1350</td>
<td>--</td>
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</table>
Soil test P poor predictor of soil total P

\[ y = 3.5x + 440 \]

\[ R^2 = 0.42 \]
Soil test P and percent organic matter together good predictors of soil total P

Soil total P = -77.8 + 170 (OM%) + 2.5 (Bray P)

R²=0.92
Particulate P concentrations can be predicted with soil test P and soil organic matter.
Summary

• Based on preliminary data, total P in soils can be predicted from Bray P-1 soil test P and soil organic matter content.

• Soil test P- total soil P relationships will be refined using data from an on-going comparison.