Soil pH in Relation to Brown Stem Rot and Soybean Cyst Nematode

N.C. Kurtzweil\textsuperscript{1}, C.R. Grau\textsuperscript{1}, A.E. MacGuidwin\textsuperscript{1}, J.M. Gaska\textsuperscript{2}, and A.W. Kaszubowski\textsuperscript{1}

Departments of \textsuperscript{1}Plant Pathology and \textsuperscript{2}Agronomy
University of Wisconsin; Madison
Soybean Cyst Nematode (SCN)

- Damage caused by *Heterodera glycines*
- Often damage is not obvious
- Obvious symptoms
  - stunting
  - chlorosis
  - open canopy
    - greater weed pressure
- Control with SCN resistant varieties and crop rotation
Brown Stem Rot (BSR)

- Caused by the pathogen *Phialophora gregata*
- Symptoms appear mid August in WI
- Control with variety selection, crop rotation
- Symptoms include
  - internal stem discoloration
  - interveinal chlorosis and leaf curling
Soil pH: Definition and Implications

• Acidity (low pH) or alkalinity (high pH) characteristic of the soil

• Measured on a log scale

• Governs nutrient availability

• Governs biological activity
Soil pH

- Measure of alkalinity or acidity on a scale of 0 to 14:
  - 0: Acidic
  - 7: Neutral
  - 14: Alkaline

- Measure of $[H^+]$ on soil particle surfaces and in soil solution

From Cornell:
www.cals.cornell.edu/dept/flori/growon/wph
Soybean Production in Wisconsin

- Yield potential is greatest at soil pH 7.0, beginning to decrease at pH of 8.0 due to low nutrient availability.

- Wide range of soil pH in Wisconsin.

- Observations of high SCN pressure in high pH; conversely, high BSR severity in low pH areas.
Initial SCN Population Increases as Soil pH Increases

![Graph showing the relationship between SCN eggs per 100 ccc soil and soil pH ranges from 5.8-6.4, 6.5-7.0, and 7.1-8.2.东 Troy, WI 1997-2001]
Soil pH Affects Yield Difference between SCN R and S Varieties

East Troy, WI 1997-2001
High Final SCN Population Densities are Associated with High Soil pH

East Troy, WI 1997-2001
Summary of SCN- Soil pH Interactions

High soil pH is associated with:
- High SCN initial population
- High SCN final population
- Greatest yield difference between SCN resistant and susceptible
Brown Stem Rot: Symptoms and Disease Ratings

**Stem** - based on % internal discoloration

**Foliar or Canopy** - based on % incidence and severity
Yield Difference Between BSR R and BSR S Varieties is Greatest at Low Soil pH

Arlington ARS, 1992-1999
BSR Severity Decreases as Soil pH Increases

East Troy, WI  2001
Procedure to Assess Levels of the BSR Pathogen in Soybean Tissue

1. Grind stem or root tissue
2. Dilution plate ground material onto semi selective media (PGM)
3. Store plates at 12 C
4. After three weeks, count BSR pathogen (= colony forming units)
PGM with BSR pathogen colonies (CFU)

Individual colony plated on non-selective medium
Population Density of BSR Pathogen Affected by Soil pH

<table>
<thead>
<tr>
<th>Soil pH</th>
<th>Stem</th>
<th>Root</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.8-6.4</td>
<td>396</td>
<td>4890</td>
</tr>
<tr>
<td>6.5-7.0</td>
<td>322</td>
<td>547</td>
</tr>
<tr>
<td>7.1-8.2</td>
<td>8</td>
<td>254</td>
</tr>
</tbody>
</table>

East Troy, WI 2000
Lowest levels of the BSR Pathogen Were Associated with Highest Soil pH

East Troy, WI 2001
Theoretical Implications of Soil pH and Effect of SCN and BSR on Yield Loss
Implications of SCN and BSR Interactions - Management Strategies

• SCN Resistant Varieties -
  Source of SCN resistance is critical

• Varieties derived from:
  – PI 88788: BSR Resistant
  – Peking: BSR Susceptible
  – Hartwig (Cyst X): BSR Susceptible, though not yet available in MG acceptable for WI
Summary

• Yield loss due to SCN is greatest at high soil pH

• Yield loss due to BSR is greatest at low soil pH
Summary

• Management Strategies
  – Determine soil pH
  – Soil sample for SCN
  – Chose appropriate rotation sequence
  – Chose appropriate variety
Resources

• Pest Management in Wisconsin Field Crops 2002 (A3646)

• Soybean Plant Health Website
  – www.plantpath.wisc.edu/soyhealth
Acknowledgements

• Department of Agronomy
  – Chris Boerboom
  – Mark Martinka
  – Palle Pedersen
  – Darin Kranz

• Department of Plant Pathology
  – Ann Kinziger
  – Lee Nolden
  – Al Otto
  – Brad Sorensen