Soil Fertility
Back to Basics with P and S.
When to inoculate?

Brian Krienke and Charles Shapiro

How do you determine how much fertilizer/manure to apply?
Soil tests? 
Crop removal?

Which nutrients do you apply every year, every acre?
Fertilizer inputs & soybean yields

Higher yields in fields that received starter fertilizer or a large P application indicate that N (early in the season) and P supply may be limiting yields in an important # of fields.


SOYBEAN MANAGEMENT FIELD DAYS

How much money do you want to make from your fertilizer?

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What does previous research say about P and S?

- On farm research trials
- Soybean Management Field Day Research
- Other research

On-farm research trials: Phosphorus

- How many?
- What did they test?
- What did they find out?
- Did they agree with our recommendations?
On-farm research trials:

• On farm research trials
Table 2: 2016 phosphorus and sulfur fertility study treatments located at Cordova, Orchard, Schuyler.

<table>
<thead>
<tr>
<th>Treatment Combinations</th>
<th>Phosphorus (lbs P$_2$O$_5$ acre$^{-1}$)</th>
<th>Sulfur (lbs S acre$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>

SOYBEAN MANAGEMENT **FIELD DAYS**

Soybean value $= \$$

Pound of P$_2$O$_5$ $=$

Pound of nitrogen $=$

Pound of sulfur $=$

Pound of K$_2$O $=$

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### Soil Nutrient and Production Factors

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Chapman</th>
<th>Orchard</th>
<th>Cordova</th>
<th>Schuyler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sandy Loam</td>
<td>Thurman Loamy</td>
<td>Clay Loam</td>
<td>Clay Loamy</td>
</tr>
<tr>
<td>Soil pH</td>
<td>7.9</td>
<td>6.9</td>
<td>6.1</td>
<td>7.0</td>
</tr>
<tr>
<td>Buffer pH</td>
<td>7.2</td>
<td>7.2</td>
<td>6.7</td>
<td>7.2</td>
</tr>
<tr>
<td>Organic Matter LOI %</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Nitrates Lbs./acre</td>
<td>9</td>
<td>15</td>
<td>11</td>
<td>50</td>
</tr>
<tr>
<td>Phosphorus Mehlich III ppm</td>
<td>23</td>
<td>89</td>
<td>31</td>
<td>18</td>
</tr>
<tr>
<td>Potassium ppm</td>
<td>169</td>
<td>144</td>
<td>324</td>
<td>281</td>
</tr>
<tr>
<td>Sulfate-S ppm S</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Zinc ppm</td>
<td>2.2</td>
<td>1.9</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Iron ppm</td>
<td>12</td>
<td>32</td>
<td>81</td>
<td>60</td>
</tr>
<tr>
<td>Manganese ppm</td>
<td>2.7</td>
<td>1.3</td>
<td>16.2</td>
<td>11.4</td>
</tr>
<tr>
<td>Copper ppm</td>
<td>0.41</td>
<td>0.26</td>
<td>0.82</td>
<td>1.16</td>
</tr>
<tr>
<td>Boron ppm</td>
<td>0.34</td>
<td>0.27</td>
<td>0.49</td>
<td>0.41</td>
</tr>
<tr>
<td>CEC/Sum of Cations me/100g</td>
<td>10.8</td>
<td>6.4</td>
<td>16.8</td>
<td>21.4</td>
</tr>
</tbody>
</table>
Inoculation study on “new soybean” ground at Orchard

Table 3: 2016 inoculation fertility study treatments located near Orchard, NE.

<table>
<thead>
<tr>
<th>Treatment Combinations</th>
<th>N Rate (lbs N acre⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inoculant (Y/N)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>50</td>
</tr>
<tr>
<td>No</td>
<td>100</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>Yes</td>
<td>50</td>
</tr>
<tr>
<td>Yes</td>
<td>100</td>
</tr>
</tbody>
</table>

Inoculation study

- What will the outcome be if we did not inoculate on this site?
  - Quantify yield/profit loss/gain
  - How much of your decisions are to reduce risk?
  - How many currently inoculate?
  - Does it pay off?
What does recent research say?

• Are there any cases of inoculation increasing yield?
• Where are they located?
• What other considerations do we need to consider for deciding when to inoculate?
• What is UNL’s current recommendations?

PPO Herbicide Trial
Nick Arneson – Plant Pathology Research Technologist
Background

- soil applied preemergence herbicides with residual activity
  - PPO (protoporphyrinogen oxidase) inhibitors – group 14 herbicides
  - can cause damage to hypocotyl and cotyledons under certain environmental conditions
    - Low Organic Matter
    - Saturated soils
    - Cool soil temperatures (< 60 F)
    - Rainfall following emergence

Jhala et al, 2014
Background

- Seedling diseases can result in loss of stand

<table>
<thead>
<tr>
<th>Disease</th>
<th>Soil moisture</th>
<th>Soil temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pythium</td>
<td>Flooded</td>
<td>Cool (50-60 F)</td>
</tr>
<tr>
<td>Phytophthora</td>
<td>Flooded</td>
<td>Warm (70s F)</td>
</tr>
<tr>
<td>Fusarium</td>
<td>Wet to dry</td>
<td>Cool to warm</td>
</tr>
<tr>
<td>Rhizoctonia</td>
<td>Damp to wet</td>
<td>Warm (70-80s F)</td>
</tr>
</tbody>
</table>
Overview

Objectives

1. Investigate interaction between soil applied PPO herbicides and common seedling diseases of soybean in Nebraska
2. Determine if fungicide seed treatment aids in protection from diseases when PPO injury occurs

**2016 PPO Herbicide Trial Treatments**

<table>
<thead>
<tr>
<th>2 Varieties</th>
<th>2 Seed Treatments</th>
<th>3 Herbicide Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitive to PPO</td>
<td>No seed treatment</td>
<td>Roundup (glyphosate) 32 oz/A + 17 lb/gal AMS</td>
</tr>
<tr>
<td>Tolerant to PPO</td>
<td>Fungicide</td>
<td>Roundup 32 oz/A + 17 lb/gal AMS + Valor 5 oz/A (flumioxazin)</td>
</tr>
<tr>
<td></td>
<td>(Apron XL 7.5 g/100kg seed + Maxim 4FS 2.5g/100kg seed + Vibrance 2.5g/100kg seed)</td>
<td>Roundup 32 oz/A + 17 lb/gal AMS + Spartan 8 oz/A (sulfentrazone)</td>
</tr>
</tbody>
</table>
Overview

- Data Collection
  - Plant population
  - % incidence of PPO injury
  - Plant Vigor
  - Root rot ratings at V2-V5 growth stage
  - Determine most abundant seedling pathogens
  - Record final yield (bu/A)

Going Forward

- Maintain trials until harvest
- Continue data collection
- Data analysis
- Provide data summary in end of season grower report
Weed Management in Conventional Soybeans
Rodrigo Werle
UNL Cropping Systems Specialist - WCREC

Challenges of Conventional Soybeans:
- Seed availability and variety selection
- Misapplication and drift of glyphosate to non-GR varieties
- Weed identification and size is more critical than for GR soybeans
Why Conventional Soybeans:
- Price of glyphosate-resistant (GR) vs conventional seeds
- Occurrence of GR weeds
- “Premiums” for non-GMO soybean
- Management of GR weeds?!??
Glyphosate-Resistant Weeds:
- common waterhemp
- Palmer amaranth
- marestail/horseweed
- Kochia
- giant Ragweed
- common ragweed

Weed management without glyphosate can be challenging
“One-size-fits-all” will not work

There are other herbicide options!

Timing and weed size!
“Start Clean, Stay Clean”

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Yield Loss (%) of Soybeans with NO PRE and PRE fb glyphosate

Unpublished data
Oliveira, M., Dr. Knezevic Lab

It’s not just glyphosate that weeds have evolved resistance to
No new herbicide site of action in nearly 30 years!

Weed Management in [Conventional] Soybeans:

- Multiple herbicides with different mechanisms of action
- Mixes
- Sequence
- Across seasons

- Tillage
  - Pre-plant
  - In crop cultivation
  - Post harvest

- Crop rotation
- Plant population
- Row spacing
- Planting date
- Fertilizer placement
- Cover crops

Source: WSSA Herbicide Resistance Management Lesson

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Herbicide SOA Diversity in Soybeans

Dr. Andrew Kniss; http://weedcontrolfreaks.com

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Narrow-Row Spacing:

- can reduce the likelihood of weed resurgence in soybeans (faster rate of canopy closure and reduction in light interception at the soil surface).

- delays in herbicide application are less likely to cause yield reductions in narrow- compared to wide-row soybean systems.

Bradley (2006)
Conventional Soybean Variety Production Study
RCBD, 4 Reps, 2 X 2 X 2 Factorial:
- 2 row spacing (15 and 30 inches)
- 2 fungicide + insecticide treatment (YES and NO)
- 2 herbicide programs:
  PRE only (Fierce + Prowl H2O + Glyphosate)
  PRE + POST (Pursuit + Cobra + Outlook)