Soybean’s Element of Surprise: Sulfur?

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Sulfur: Who Needs It...Maybe You?

Total deposition of sulfur

2001

2015

Source: CASTNET/CMAQ/NTN/AMON/SEARCH USEPA 09/14/16

EPA, 2016

Which Indiana Crops Should Be the Most Responsive to Sulfur?
# How Much S Does Soybean Need?

<table>
<thead>
<tr>
<th>Grain</th>
<th>lb/bu</th>
<th>50 bu</th>
<th>75 bu</th>
<th>100 bu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>3.30</td>
<td>165</td>
<td>248</td>
<td>330</td>
</tr>
<tr>
<td>P&lt;sub&gt;2&lt;/sub&gt;O&lt;sub&gt;5&lt;/sub&gt;</td>
<td>0.73</td>
<td>37</td>
<td>55</td>
<td>73</td>
</tr>
<tr>
<td>K&lt;sub&gt;2&lt;/sub&gt;O</td>
<td>1.20</td>
<td>60</td>
<td>90</td>
<td>120</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.18</td>
<td>9</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total S</strong></td>
<td><strong>0.35</strong></td>
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<td><strong>26</strong></td>
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</tbody>
</table>
### Early Growth (aka Vegetative Stages) Leaf Nutrient Sufficiency Ranges

<table>
<thead>
<tr>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 to 5.5</td>
<td>0.30 to 0.60</td>
<td>1.7 to 2.5</td>
<td>1.1 to 2.2</td>
<td>0.03 to 0.60</td>
</tr>
</tbody>
</table>

### Flowering (aka R2) Leaf Nutrient Sufficiency Ranges

<table>
<thead>
<tr>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.25 to 5.0</td>
<td>0.30 to 0.60</td>
<td>1.5 to 2.25</td>
<td>0.8 to 1.4</td>
<td>0.25 to 0.70</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>S</th>
<th>Manganese</th>
<th>Zinc</th>
<th>Copper</th>
<th>Boron</th>
</tr>
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<tbody>
<tr>
<td>0.25 to 0.60</td>
<td>17 to 100</td>
<td>21 to 80</td>
<td>4 to 30</td>
<td>20 to 60</td>
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</tbody>
</table>

Soy chapter – Sabbe et al., 2000
Leaf Nitrogen @ R2, R4, R6

MG 2  MG 3

R2 Sufficiency = 3.25 to 5.0% N

2011 & 2012: W. Lafayette

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Leaf Sulfur @ R2, R4, R6

R2 Sufficiency = 0.25 to 0.60% S

2011 & 2012: W. Lafayette
Preliminary Results of Soybean Response to Sulfur

AMS @ 20 lb N/ac       Urea @ 40 lb N/ac
Rice RESCUE Yields

Yield (bu/ac)

UTC
Urea 40
Urea 20
AMS 20
AMS 10
Coron 10
UAN 10
Task
Mn
Priaxor
Stratego
Rachet
X-cyte
Bio-forge
C + TF
C + P
C + R
C+TF+P+R

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Rice Happy Yields

UTC | Urea 40 | Coron 10 | Task Force | Priaxor | Bio-forg CN | C + TF | C + P
--- | --- | --- | --- | --- | --- | --- | ---
Yield (bu/ac) | 60 | 55 | 50 | 55 | 55 | 50 | 50 | 50

LaCrosse, IN – 2015
Sulfur Studies at LaCrosse in 2016
Sulfur Season Treatments

- Untreated

- Broadcast @ 20 lb S/ac with MES10 or AMS

- Single foliar @ 5 lb S/ac at:
  - V4, R2, R4, R6

- Sequential foliar combos @ 5 lb S/ac per pass
  - V4 + R2
  - V4 + R4
  - R4 + R6
  - V4 + R2 + R4 + R6
No Sulfur

20 lb S/acre
2016 Nitrogen @ R3 (18 d after R2)

Fisher’s Protected LSD$_{0.05}$
2016 Sulfur @ R3 (18 d after R2)

Fisher’s Protected LSD$_{0.05}$
2016 N:S @ R3 (18 d after R2)

Fisher’s Protected LSD$_{0.05}$
2016 Sulfur Responsiveness

• **Broadcast** @ 20 lb S/acre: + 8.5 to 12.5 bu

• **Single foliar** @ 5 lb S/acre: + 6 to 10 bu

• **Sequential foliar combos**: up to 12 bu
  – No response (i.e., crop phytotoxicity) with foliar applications at all four timings (V4, R2, R4, R6)
2017 Sulfur Response
No Sulfur  

20 lb S/acre
No Sulfur

20 lb S/acre
No Sulfur
31 pods
17 nodes
1 branch

20 lb S/acre
45 pods
18 nodes
2 branches
2017 Sulfur Season @ LaCrosse

+ 13 bu with broadcast

+ 4 to 7 bu with foliar AMS

Yield (bu/ac)

UTC  MES10  AMS  V4  R2  R4  R6  V4+R2  V4+R4  R4+R6  All Foliar

d  a  ab  cd  bcd  cd  cd  cd  abc  abc  d

Fisher’s Protected LSD0.05
Soybean Sulfur – La Crosse
S Season at LaCrosse: Sept 11, 2017
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S Season at LaCrosse: Sept 11, 2017

UTC | AMS

UTC | AMS
AMS 20 lb S | Untreated
2017 Sulfur Responsiveness

- **Broadcast** @ 20 lb S/ac: + 13 bu
  - Similar to 2016
- **Single foliar** @ 5 lb S/ac: + 4 to 7 bu
  - Not as good as 2016
- **Sequential foliar combos**: + 5 to 7.5 bu
  - No response (i.e., crop phytotoxicity) with foliar applications at all four timings (V4, R2, R4, R6)
  - Not as good as 2016
## How Much S Does Soybean Need?

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How Much Sulfur to Apply for Soy?

- Timing of Application
- Fertilizer Source
- Severity or Need
- Soil Type
- Field Conditions

- Starting point is ~20 lb S/ac on broadcast fertilizer late spring to early vegetative growth
- What about foliar sprays?
2018 Season Considerations

- **Soil test?** Mehlich-3 extraction for S closer to planting may help... no guarantees
- **Late Spring Broadcast of 20 lb S/ac**
  - **AMS**, AMS:ES blends, MES10, Sul-Po-Mag, Gypsum...
  - Elemental S probably won’t oxidize fast enough
- **Wait and See: Leaf Nutritional Snapshot**
  - May need to consider application “close” to critical S levels (0.25%) or near the 20:1 (N:S ratio)...maybe more like ~18:1