Evaluation of Phosphorus Rates on Soybean as a Tool to Increase Yield and Protein

Cooperators: Doug Nelson, Roger & David Black, Gerald Nordick
Collaborators: George Rehm
Nearest town: Ada, Rindal, Rothsay
Variety: Traill, Mycogen 5007, Pioneer 90B53RR
Planted: May 27, June 10, May 23
Harvested: Oct. 13, Oct. 8, Oct. 8

Purpose of study:
New soybean cultivars with higher yield potentials have been developed for the region over the past ten years and this prompted the idea to conduct a phosphorus rate study to determine if the phosphorus nutritional needs of the crop were still being met from residual phosphorus in the soil. Last years research showed significant increases in yield and protein with the addition of P2O5 on lower testing soils.

Ada Site:
Soil Test

<table>
<thead>
<tr>
<th>Olsen P</th>
<th>10 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>156 ppm</td>
</tr>
<tr>
<td>Organic matter</td>
<td>4.7%</td>
</tr>
<tr>
<td>pH</td>
<td>8.3</td>
</tr>
<tr>
<td>Carbonates</td>
<td>10.1%</td>
</tr>
<tr>
<td>Soluble salts</td>
<td>0.54 mmho/cm</td>
</tr>
</tbody>
</table>

Results: There was no significant difference in yield, protein percent or oil percent at this location in 2003.

Rindal Site:
Soil Test

<table>
<thead>
<tr>
<th>Olsen P</th>
<th>8 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>92 ppm</td>
</tr>
<tr>
<td>Organic matter</td>
<td>4.2%</td>
</tr>
<tr>
<td>pH</td>
<td>8.0</td>
</tr>
<tr>
<td>Carbonates</td>
<td>5.1%</td>
</tr>
<tr>
<td>Soluble salts</td>
<td>0.35 mmho/cm</td>
</tr>
</tbody>
</table>

Results: There was no significant difference measured on soybean yield. There was a 1.3% increase in protein percent however it was not statistically significant.

Rothsay Site:
Soil Test

<table>
<thead>
<tr>
<th>Olsen P</th>
<th>7 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>130 ppm</td>
</tr>
<tr>
<td>Organic matter</td>
<td>3.1%</td>
</tr>
<tr>
<td>pH</td>
<td>7.9</td>
</tr>
<tr>
<td>Carbonates</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

Results: There were no significant differences for soybean yield, protein concentration or oil concentration at this site in 2003. Fifteen inches of rain was received at this site early in the growing season which reduced yields significantly.

Treatment means for Yield, Protein% and Oil%.

<table>
<thead>
<tr>
<th>P2O5 Rate Lb/A</th>
<th>Yield Bu/A</th>
<th>Protein %</th>
<th>Oil %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>24.3</td>
<td>35.5</td>
<td>18.8</td>
</tr>
<tr>
<td>20</td>
<td>22.8</td>
<td>35.5</td>
<td>18.8</td>
</tr>
<tr>
<td>40</td>
<td>24.2</td>
<td>35.7</td>
<td>18.8</td>
</tr>
<tr>
<td>60</td>
<td>24.5</td>
<td>35.9</td>
<td>18.9</td>
</tr>
<tr>
<td>80</td>
<td>21.6</td>
<td>35.5</td>
<td>18.8</td>
</tr>
<tr>
<td>100</td>
<td>24.1</td>
<td>35.5</td>
<td>18.9</td>
</tr>
</tbody>
</table>

Significance: N.S.

Treatment means for Yield, Protein% and Oil%.

<table>
<thead>
<tr>
<th>P rate Lb P2O5/A</th>
<th>Yield Bu/A</th>
<th>Protein %</th>
<th>Oil %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>40.4</td>
<td>31.3</td>
<td>19.4</td>
</tr>
<tr>
<td>20</td>
<td>39.3</td>
<td>31.6</td>
<td>19.1</td>
</tr>
<tr>
<td>40</td>
<td>39.8</td>
<td>32.0</td>
<td>19.0</td>
</tr>
<tr>
<td>60</td>
<td>42.6</td>
<td>31.7</td>
<td>19.2</td>
</tr>
<tr>
<td>80</td>
<td>40.8</td>
<td>32.6</td>
<td>19.0</td>
</tr>
<tr>
<td>100</td>
<td>40.8</td>
<td>31.1</td>
<td>19.5</td>
</tr>
</tbody>
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Significance: N.S.

Treatment Means for Yield, Protein% and Oil%.

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<th>Yield Bu/A</th>
<th>Protein %</th>
<th>Oil %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25.3</td>
<td>37.1</td>
<td>18.2</td>
</tr>
<tr>
<td>20</td>
<td>27.7</td>
<td>36.4</td>
<td>18.6</td>
</tr>
<tr>
<td>40</td>
<td>25.6</td>
<td>36.9</td>
<td>18.4</td>
</tr>
<tr>
<td>60</td>
<td>25.5</td>
<td>37.0</td>
<td>18.4</td>
</tr>
<tr>
<td>80</td>
<td>29.3</td>
<td>36.7</td>
<td>18.7</td>
</tr>
<tr>
<td>100</td>
<td>25.3</td>
<td>37.3</td>
<td>18.2</td>
</tr>
</tbody>
</table>

Significance: N.S.

Source: 2003 On-Farm Cropping Trials Northwest and West Central Minnesota
U of MN Extension Service, published January 2004

For additional information: Russ Severson
Evaluation of Phosphorus Application — (continued)

Soybean protein concentration at phosphorus sources and rates.

<table>
<thead>
<tr>
<th>Source</th>
<th>P$_2$O$_5$ Rate</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>DAP</td>
<td>37.2</td>
<td>37.0</td>
</tr>
<tr>
<td>MAP</td>
<td>36.7</td>
<td>36.8</td>
</tr>
<tr>
<td>TSP</td>
<td>36.5</td>
<td>37.1</td>
</tr>
</tbody>
</table>

Soybean oil concentration at phosphorus sources and rates.

<table>
<thead>
<tr>
<th>Source</th>
<th>P$_2$O$_5$ Rate</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>DAP</td>
<td>18.7</td>
<td>18.5</td>
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<tr>
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<td>18.6</td>
</tr>
<tr>
<td>TSP</td>
<td>18.8</td>
<td>18.3</td>
</tr>
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Funding: Minnesota Soybean Research and Promotion Council

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