2022 fertility management options and high fertilizer prices

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Professor and soil fertility specialist

Overview
• Phosphorus: sufficiency vs draw down options
  – $S$ return to P fertilizer across soil test levels
  – Value of starter fertilizers (macros and micros)
• Nitrogen: Economic optimum N, and management for efficiency
• Sulfur, pH and manure options

Phosphorus management model based on soil test

Application based on crop removal only up to 30 ppm

Mehlich 3 Soil Test (ppm)
Sufficiency recommendations
• Traditional recommendation system used in the Great Plains/Corn Belt.
• Estimates the amount of P and/or K that provides optimum economic returns in the year of application.
• Over time soil test values equilibrate in the crop responsive range (low).
• Nutrient application required for every crop, every year.

Build and maintain recommendations
• Focus on maintaining soil test values in non-responsive range, slightly above "critical level".
• Nutrient application is not required every year.
• Provides flexibility in nutrient application, time management and cash flow.
• Higher fertilizer costs than sufficiency programs in early years. Requires an investment to "Build" soil test.

$ return to 60 lbs of P2O5 in the year of application in corn

- Corn: $5.25/bu
- P2O5: $0.86/lb

12 locations in 2021
Yield response to 60 lbs of P2O5 in the year of application in corn

Optimum range and use of starters?

$ return to 40 lbs of P2O5 in the year of application in wheat (broadcast)

Soil sampling

- Soil test is very useful, especially during unfavorable prices.
- Use good sampling methods for good quality information.
  - Use the right sampling depth for right recommendations.
  - Good number of subsamples
  - One sample should represent the field variability.
Variable rate application?
• Identify parts of a field that could respond to higher rates of fertilizer.
• Savings from reduced fertilizer application: if non-responsive areas of a field are identified.
• Benefits can only be determined on a field-by-field basis.

Mehlich-3 vs other methods
• Normal Soil (used)
• High pH Soil (removed)

Starter fertilizers: the role of P (and N)
**Starters: efficient option for micros (when needed)**

<table>
<thead>
<tr>
<th>Starter Treatment</th>
<th>None</th>
<th>NPK</th>
<th>NPK + M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain yield (bu/acre)</td>
<td><img src="image1.png" alt="Graph" /></td>
<td>p&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

**Sorghum yield with band-applied Zn**

<table>
<thead>
<tr>
<th>Soil test Zn (DTPA) 0.6 ppm</th>
<th>+Zn</th>
<th>-Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain yield (bu/acre)</td>
<td><img src="image2.png" alt="Graph" /></td>
<td>95 94</td>
</tr>
</tbody>
</table>

**Yield response to N: maximum agronomic vs economic optimum**

- **Economic Optimum**
- **Agronomic Optimum**

\[ y = 78 + 0.89x - 0.0019x^2 \]
Economic optimum N rate at different corn: N price ratios

- EONR and return to N decrease with decreasing corn : N price ratio
- Corn : N price ratio >10: max. return is not very sensitive to over-application of N
- Corn : N price ratio <10: max. return is very sensitive to over-application of N

Nitrogen additives:

- Urease inhibitors for side-dress urea

Use of nitrification inhibitor (N-serv-e) with NH3 (150 lbs/a)
Corn response to nitrogen (N) applied with and without PivotBio-Proven

Plant N uptake

Grain yield

Nitrogen fertilizer efficiency with improved management in corn

Nitrogen rate (lbs/acre) vs. Grain yield (bu/acre)

What nutrient is limiting yield?
Soybean response to P fertilizer vs soil test P (and pH)

Target pH and yields

- For most cropping situations target pH of 6.0-6.4
- pH values can vary significantly across the field: use variable rate application!

Sulfur management and soil test

- Soil organic matter and soil texture can help with interpretation
- Need profile samples
- Rate of mineralization can be difficult to estimate
- High demand for S during the rapid growth of corn and wheat, and relatively shallow rooting can contribute to poor correlation
Sulfur in corn for contrasting soil texture

Responsive to S:
• Sand content: > 20%
• Profile S: < 2 ppm

Manure nutrients

<table>
<thead>
<tr>
<th>% Dry Matter</th>
<th>Total N</th>
<th>NH₄</th>
<th>P₂O₅</th>
<th>K₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>21</td>
<td>9</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Beef</td>
<td>50</td>
<td>21</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Swine</td>
<td>18</td>
<td>8</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Poultry</td>
<td>75</td>
<td>56</td>
<td>36</td>
<td>45</td>
</tr>
</tbody>
</table>

Average animal manure micronutrient content of different sources

<table>
<thead>
<tr>
<th>Manure source</th>
<th>Iron</th>
<th>Manganese</th>
<th>Boron</th>
<th>Zinc</th>
<th>Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy solid</td>
<td>0.5</td>
<td>0.06</td>
<td>0.01</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Swine solid</td>
<td>19.0</td>
<td>1.09</td>
<td>0.04</td>
<td>0.79</td>
<td>0.50</td>
</tr>
<tr>
<td>Poultry</td>
<td>3.0</td>
<td>0.61</td>
<td>0.08</td>
<td>0.48</td>
<td>0.66</td>
</tr>
</tbody>
</table>

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<th>Zinc</th>
<th>Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy liquid</td>
<td>0.9</td>
<td>0.11</td>
<td>0.03</td>
<td>0.11</td>
<td>0.12</td>
</tr>
<tr>
<td>Swine liquid</td>
<td>2.5</td>
<td>0.23</td>
<td>0.06</td>
<td>1.03</td>
<td>0.62</td>
</tr>
</tbody>
</table>
Manure nitrogen and phosphorus availability

- Inorganic N is all available.
- Organic N available the first year compared with fertilizer (MF-2562):
  - Liquid manure: 30%
  - Solid manure: 25%
  - Compost: 20%
- Phosphorus: Research show near 100% availability

Considerations with current economics

- Use good soil test information to make the right decision.
- Don’t reduce P in low testing fields, profits are very likely.
- Return to fertilizer in high testing soils may be limited with current conditions (use “reserve soil nutrients”).
- Current prices may require more soil sampling, and focus on nutrients with highest ROI.

Thank you!

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