GOAL - Precision Nutrient Management

• Identify and quantify variability within fields.
• **Understand** the impact of variability.
• Manage variability to increase profits while reducing environmental risks.

Topics

1. Nutrient Placement
2. Timing of Application
3. Technology for Accurate Field Execution
4. On-Farm Research Documentation

Ohio State Precision Ag Program

www.OhioStatePrecisionAg.com
Twitter: @OhioStatePA
Facebook: Ohio State Precision Ag
Nutrient Application Opportunities in Corn

Nitrogen Application Windows

<table>
<thead>
<tr>
<th>Growth Stage</th>
<th>Total N Uptake</th>
</tr>
</thead>
<tbody>
<tr>
<td>V6</td>
<td>5%</td>
</tr>
<tr>
<td>V10</td>
<td>18%</td>
</tr>
<tr>
<td>R</td>
<td>60%</td>
</tr>
</tbody>
</table>

Image Source: www.Pioneer.com

Corn Stages by N Uptake

Pre-plant Application (Fall or Spring)  
Starter @ Plant  
Side-dress  
Mid-season  
Late-season  

Percent of Total Nitrogen Uptake by plant

0%  50%  100%
Complexity of Nutrient Management

- Every year is unique
- Weather over the season
- Soil conditions and mineralization
- Timing window for applications
- Application tools for proper placement
- Investment / profitability for nutrient applications
Fertilizer Placement Options

**Broadcast** - fertilizer is broadcast on the soil surface, usually some incorporation with either primary or light tillage.

**Starter Fertilizer (Planter)**
- **Starter** - fertilizer placed in a band near the seed in the planting operation (2x2); band can be at various distances from the seed.
- **Pop-Up** - fertilizer placed in contact with seed, liquid and dry materials can be used as “pop-up” fertilizer.
- **Relay** – fertilizer placed using a combination of starter (2x2) and pop-up.

**Deep Band (injection)** – fertilizer placement in a band at a depth of 4 to 8 inches below the soil surface; frequently used in conservation tillage systems.

**Shallow Injection** – fertilizer placed using coulters at a depth of 2 to 3 inches (e.g. side-dress)

**Surface Band** - fertilizer placed in a band on the soil surface; could be incorporated with either a primary or secondary tillage operation.

**Dual Band** - combination of a pre-plant application of anhydrous ammonia and liquid fertilizer, two lines attached to one shank.
Nutrient Placement Options

Planter Placed Options

- Pop-Up 2x2 Setup
- Planter Frame Storage

Side-Dress Application

- Side-dress unit with by-row PWM rate control

Mid-Late Season Options

- High Clearance mid/late season application equipment
- Y-Drop Application (above)
- Spreader (below)

New technology expands placement and timing options while improving field execution accuracy.

Placement can be adapted to varying nutrient needs.

Broader application methods allows for tailored BMPs.

Nutrient placement options provides the opportunity to increase yields, ROI, etc.
Strip-till / Injection Technology

Strip-till Considerations

- **Proper P placement** – universal solution may not be possible with varying soils and terrain.
- **Proper P mixing** - may require correct shanks/attachments for soil type.
- **Ground speed** – field capacity (ac/hr) / application window
- **RTK GPS Correction** – recommended to either center planted row within strip or relative to nutrients.
- **Benefit** – place P in natural uptake zone where nutrient stratification exists.
## Investment Opportunity Decisions

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Stress Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergence</td>
<td>Replant; Front-end nutrition</td>
<td>Green</td>
</tr>
<tr>
<td>V4-V7</td>
<td>Rows per ear determined, switch to nodal roots (Girth)</td>
<td>Orange</td>
</tr>
<tr>
<td>V6-V10</td>
<td>Number of kernels per row determined (Length)</td>
<td>Red</td>
</tr>
<tr>
<td>VT-R1</td>
<td>Pollination</td>
<td>Question mark</td>
</tr>
<tr>
<td>R2-R3</td>
<td>Kernel abortion</td>
<td></td>
</tr>
<tr>
<td>R4-R6</td>
<td>Kernel size</td>
<td></td>
</tr>
</tbody>
</table>

- Pollination Window (Temperature)
- Subsoil Moisture Condition
Aiming for “Optimum” N Rates

Adaptive N Mngt

• Adjust as appropriate for N loss conditions...
• Soil mineralization of N....
• Set N budget for each field
  - Assess your own N loss risk (imagery & models)
  - +/- 30 to 40 lbs. N in any given year

Field-by-field basis (build field database)

Consideration: Good Starter, Solid Side-dress, Late-season

Strive to improve your nutrient management and consider on-farm research.