Field and Spring Placement of Nitrogen Fertilizers. Where do Enhanced Efficiency Fertilizers Fit?

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**Introduction**

There are three mechanisms of nitrogen (N) losses depicted below:

- Ammonia volatilization occurs due to hydrolysis causing a rapid rise in pH around unprotected urea granules. The high pH results in more ammonia:

- There are a number of recommended practices to reduce volatilization:
  - Use of urease inhibitors (Watson, 1990)
  - Slow-release forms (Rao, 1987) and
  - Irrigation shortly after application (Holcomb et al., 2011)

- Most common - incorporation of the fertilizer into the soil (Harapiak et al., 1986).

**Background on shallow banding**

- Some of the pioneer work on shallow banding was carried out by Nyborg (1986) as quoted by Harapiak et al. (1986).

<table>
<thead>
<tr>
<th>Method of placement</th>
<th>Yield increase (kg ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow mix</td>
<td>915</td>
</tr>
<tr>
<td>Deep mix</td>
<td>130</td>
</tr>
<tr>
<td>Shallow band</td>
<td>1130</td>
</tr>
<tr>
<td>Deep band</td>
<td>1400</td>
</tr>
</tbody>
</table>

- Work involves research by Rochette and coworkers (2009 and 2010)

- Also, demonstrations in Ontario and Manitoba
  - [http://www.ontariosoilcrop.org/cropadvances.htm](http://www.ontariosoilcrop.org/cropadvances.htm)

**Why the interest now?**

- Fluctuating prices of nitrogen fertilizer and crops
- Efforts to reduce NH₃ and N₂O emissions, and nutrient leaching and run-off
- Long periods from application to crop demand
- Susceptible to loss

**Enhanced Efficiency Fertilizers (EEF)**

Enhanced Efficiency [Fertilizer] describes fertilizer products with characteristics that allow increased [nutrient availability] and reduce potential of nutrient losses to the environment e.g., gaseous losses, leaching or runoff when compared to an appropriate reference product. (Tentative 2015, Association of American Plant Food Control Officials)

Types of EEF

- Uncoated slowly available fertilizers containing N, e.g., urea-aldehyde condensation products (e.g., urea-formaldehyde reaction products, IBUD), triazines, etc.
- Physical coating or barrier around soluble N fertilizer, e.g., SCU, PCU, combination products
- Stabilizers, e.g., nitrification and urease inhibitors

**Benefit of deep banding**

Ammoniacal N from urea is retained in the soil because of a resistance in upward diffusion (Sommer et al., 2004).

**What is new?**

- Zero till urea or UAN bands in one-pass systems are seldom more than 1 1/2” - 2” deep.
- Shallow placement of nitrogen may cause higher losses.
- The belief that “it’s in the soil it’s safe” may be misguided.
- New research is indicating that shallow banded urea and UAN are susceptible to volatilization losses.

**Field research program**

- Five sites in 2014, seven in 2015 and seven in 2016
- Three products (Urea, Urea + AGROTAIN® stabilizer, SUPERU® fertilizer)
- Three placements (broadcast, two-depths of banding)
- Two placement times in 2015 and 2016 (fall and spring)
- Two rates, recommended and 75% of recommended
- Replicated four times

**Key Results and Discussion**

**Overall statistical effects**

<table>
<thead>
<tr>
<th>Effect</th>
<th>AB</th>
<th>VS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>0.011</td>
<td>0.09</td>
</tr>
<tr>
<td>Urea*placetime</td>
<td>0.011</td>
<td>0.04</td>
</tr>
<tr>
<td>Urea*trt</td>
<td>0.001</td>
<td>0.89</td>
</tr>
<tr>
<td>Urea<em>placetime</em>trt</td>
<td>0.16</td>
<td>0.84</td>
</tr>
</tbody>
</table>

**Spring treatments**

- Canola Yield Benefit with Spring Shallow Banding (AGROTAIN®)
- Canola Yield Benefit with Spring Broadcasting (SUPERU®)

**Fall treatments**

- Canola Yield Benefit with Fall Shallow Banding (AGROTAIN®)
- Canola Yield Benefit with Fall Broadcasting (SUPERU®)

Deep banding remains the standard placement method of urea-based fertilizers. However, as the farm size increases, farm operators are seeking operational efficiencies, often at the expense of agronomic efficiencies. The results of this project support the use of nitrogen stabilizers to minimize the risk of nitrogen losses when deep banding placement is replaced with either shallow banding or broadcast.

**References**