New Developments in Sulfur Coating Technology

Fred Carney
Agrium Advanced Technologies
Fertilizer Outlook and Technology Conference
Charleston, SC Nov 2008
AAPFCO current definition is “a coated slow release fertilizer consisting of urea particles coated with sulfur. The product is usually coated with a sealant … and a conditioner… It typically contains about 30% - 40% nitrogen and about 10% to 30% sulfur.” 1980
• Tennessee Valley Authority developed the technology in 1968-1978
• TVA pilot plants 1960-1979
• CIL (now Agrium Advanced Technologies), Courtright, ON 1975
• Tennessee Valley Authority demonstration plant 1978-1982
• LESCO (now Turf Care Supply), built 1980
• Scott’s Co., built 1982
• Pursell Technologies (now AAT), Sylacauga, AL built 1985
• TVA Technology – hydraulic spraying of the sulfur and a sealant layer of oil-polyethylene mix and a top coating of diatomaceous earth

• Scott’s introduced usage of a polymer-wax blend top coat in 1989.

• LESCO (now TCS) and Nu-Gro followed suit in the late 1990’s.

• Use of smaller orifice sulfur nozzles for better sulfur distribution.

• Pursell Technologies (AAT) developed a thermoset polyurethane in 1993.

• AAT developed new polymer coating sealant technology in 2008
synthetic organic fertilizers

release of sulfur coated urea

H₂O
synthetic organic fertilizers

release of sulfur coated urea
synthetic organic fertilizers

release of sulfur coated urea
synthetic organic fertilizers

release of sulfur coated urea
Granules that get coated too thickly with sulfur during manufacturing and remain unreleased
synthetic organic fertilizers

release of sulfur coated urea

% N Released

Time (weeks)

Urea

PCSCU (locked off)
Lock Off Comparisons

% N

37%  • SCU = 40%

42%  • TriKote = ~10 %

43%  • XCU = < 10%
Polymer Coating Process

- Raw Material Storage
- Feeder
- Heater
- Polymer Coating Drum
- Chemical pumps
- Cooler
- Screener
- Product Storage
synthetic organic fertilizers

polymer coated urea (PCU)

Temperature Controlled Diffusion
Performance Enhanced!

Typical Polymer Coated Urea Release Curve

- Absorption phase
- Steady state release
- Declining release

Percent Release vs. Time, Weeks

0 7 14 21 28 35 42 49 56 63 70 77 84 91 98
Factors affecting nutrient release from a polymer coated urea

- Temperature (soil)
- Coating thickness
- Moisture (soil, enough to grow plants)
What is it?

XCU™ is Agrium Advanced Technologies' latest branded product line that combines industry-leading, polymer- and sulfur-coating technologies. A new polymer sulfur coating technology, XCU fertilizer, with its distinct “XCU” color, delivers more Nitrogen – the highest concentration in the industry – while adding durability and consistency.

43–0–0 analysis
Patent applied for in 2008 but not yet published product line so details of the coating technology are still a **SECRET**!

This technology has been installed in both Sylacauga and Courtright plants and will replace TRIKOTE®, and SCU®.
What I can tell:

• Reduced the coating content to 6.3% with 4% sulfur which increased the nitrogen content from 42% to 43%.

• Maintained product quality equal to the previous TriKote technology.
Sulfur Coating-Polymer Coating Process

- Raw Material Storage
- Feeder
- Sulfur Pump
- Chemical pumps
- Sulfur Coating Drum
- Polymer Coating Drum
- Heater
- Cooler
- Screener
- Product Storage
Attributes

• Sizes
  Regular- 250 SGN – 43% N
  Intermediate- 200 SGN – 43% N
  Mini - 150 SGN – 41% N

• Longevity
  6 – 8 week – Longevity
  New proprietary coating process – 4% sulphur coated (vs. 6% TriKote & 17% SCU)

• Packaging
  Bulk
  Bulk Bag

“Blending Economics With Agronomics™”
Attributes

• Highest Nitrogen Concentration (43% N)
• 93% CSRN (Coated Slow Release Nitrogen)
• Less risk of nutrient “lock-off”
• New Formula opportunities
• Proprietary coating for added durability
• 10% more storage space (3 more tons bin storage per truckload)
• 10% more freight savings (3.6 more tons per truck load; 16 per rail car)

“Blending Economics With Agronomics™”

“Agrium Advanced Technologies
Smarter Ways To Grow”
## Freight Comparison

<table>
<thead>
<tr>
<th>Product</th>
<th>% N</th>
<th>N/ton</th>
<th>tons/TL</th>
<th>N/TL</th>
<th>Eq. ton/TL</th>
<th>Savings @ $50/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>XCU</td>
<td>43</td>
<td>860</td>
<td>22</td>
<td>18,920</td>
<td>25.57</td>
<td></td>
</tr>
<tr>
<td>TRIKOTE</td>
<td>42</td>
<td>840</td>
<td>22</td>
<td>18,480</td>
<td>24.97</td>
<td>($29.73) vs. XCU</td>
</tr>
<tr>
<td>SCU</td>
<td>37</td>
<td>740</td>
<td>22</td>
<td>16,280</td>
<td>22</td>
<td>($178.38) vs. XCU</td>
</tr>
</tbody>
</table>

“Blending Economics With Agronomics™”
Comparisons

@ 1 lb. N/1000ft² application & 100 % “in the bag”

• With XCU 43 = 19.8 Acre coverage with 1 ton product
delivering 93% Coated Slow Release Nitrogen!

• vs. TriKote 42 = 19.3 Acres
  3% less coverage!

• vs. SCU 37 = 16.9 Acres
  17% less coverage!

“Blending Economics With Agronomics™”
50% blend of coated N with target analysis of 30-0-15 (2:0:1 ratio)

<table>
<thead>
<tr>
<th></th>
<th>with XCU 43</th>
<th>vs. SCU 39</th>
<th>vs. SCU 37</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final analysis</td>
<td>32-0-16</td>
<td>31-0-16</td>
<td>30-0-16</td>
</tr>
<tr>
<td>Spread rate</td>
<td>136 lbs./A</td>
<td>141 lbs./A</td>
<td>145 lbs./A</td>
</tr>
<tr>
<td>Coverage per ton</td>
<td>14.7 A</td>
<td>14.2 A</td>
<td>13.8 A</td>
</tr>
</tbody>
</table>

Up to 1 more Acre in coverage vs. SCU
Temperature response SCU and XCU

Performance Enhanced!
Thank You