Coatings and Inhibitors: Production and Relevance to Fertiliser Efficiency

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Enhanced Efficiency Fertilisers

- One of the fastest growing product categories in the fertiliser industry globally
- Play a critical role in nutrient use efficiency
Great Barrier Reef Protection Amendment Act 2009

‘In this chapter—

optimum amount, for the application of nitrogen and phosphorus to soil on an agricultural property, means the highest amount of nitrogen and phosphorus that can be applied without over-fertilising the property.

over-fertilisation, of an agricultural property, means that fertiliser has been applied to soil on the property at above the needs of the plants being or to be fertilised.

Implementation through 6‐easy‐steps

District yield potential

Legume crops

Mill by-products

Crop nitrogen need

Nitrogen in soil

Other inputs

= N application rate

Soil testing & OM mineralisation
4R Nutrient Stewardship

http://www.ipni.net/4R

Inhibited/Stabilised fertilisers

- Act by slowing conversion to different N forms rather than synchronising delivery to crop need
- Extend the time that N remains in the urea or ammonium form
- Half-life affected by soil temperature, soil pH, organic matter

- Do not slow or control the release of nutrients
Inhibitors

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,4-dimethylpyrazole phosphate (DMPP)</td>
<td>Nitrosomonas</td>
</tr>
<tr>
<td>2-chloro-6-(trichloromethyl)-pyridine (Nitrapyrin)</td>
<td>Nitrosomonas</td>
</tr>
<tr>
<td>Dicyandiamide (DCD)</td>
<td>Nitrosomonas</td>
</tr>
<tr>
<td>N-(n-butyl) thiophosphoric triamide (NBPT)</td>
<td>Urease</td>
</tr>
<tr>
<td>Neem coated urea</td>
<td>Nitrosomonas</td>
</tr>
</tbody>
</table>

Controlled release fertilisers

**ISO 8157:2015**  Fertilizer in which nutrient release is controlled, meeting the stated release rate of nutrient and the stated release time at a specified temperature.

- Soil moisture absorbed by granule
- Nutrients dissolve
- Nutrient slowly released to crops
Controlled release fertilisers

Why synchronise nutrient delivery?

- e.g. Sugarcane ratoon yielding 100 t/ha

Potential loss 145 kg N/ha

180 kg N (historic rate)
160 kg N (Six-ES rate)
150 kg N (crop need)

Risk reduced 20 kg N/ha

Effect of reducing rate only. Only reduces risk 12%

Why synchronise nutrient delivery?

Improving timing at the right rate. Reduced risk by 50%

Risk reduced 82 kg N/ha

Potential loss 83 kg N/ha

180 kg N (historic rate)
50% Agromaster blend
150 kg N (crop need)
Consumption of coated CR fertilisers

- Includes polymer and sulphur coated CR fertilisers
- Global consumption of coated CR fertilisers > 2 million metric tonnes p.a.
- ~ 78% used in agriculture (broadacre + specialty crops)

Inhibitor treated fertilizers (consumption estimates)

- > 3 million MT fertiliser treated in USA (2010)\(^1\)
- 129,000 MT treated in Western Europe (2009)\(^1\)
- Japan – not available, domestic production.
- China – ~ 1 million MT treated fertiliser\(^2\) (estimate)
- India – ~6.3 million MT neem coated urea (2013-14)\(^2\).
  Government policy min. 75% domestic urea neem treated (May 2015).
  Heavily subsidised.

References:
Growth in EEF production, China

- 30% growth p.a. from 2009-14
- Capacity or actual production?

Source: IHS, 2015

Consumption of CRF blends in Japanese agriculture

- Average growth ~8,000 MT p.a.
- Significant long-term experience synchronising with crop need.
Does synchronisation work?

**Cane yield at 200 kg N/ha, Burdekin**

- **Urea**
- 25%
- 50%
- 75%

**Agromaster CR in blend**

*Increasing synchronisation*

Study conducted by Farmacist & ICL-SF

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Does synchronisation work?

- 40% reduced leaching under potato (Tasmania) with 37% CR N
- CR used half the number of fertiliser applications

Study conducted by NRM North & ICL-SF
Does synchronisation work?

- Average 27% reduction in nitrous oxide emissions (average of 4 cane sites)
- Up to 40% reduction in high-loss scenarios

Studies conducted by HCPSL, Farmacist, DSITI

Summary

- Consumption of EEF’s (CR + inhibitors) exceeds 6 million tonnes (excluding India)
- CR fertilisers give control over timing (synchronisation)
- Inhibitors slow N speciation changes
- Current reef regulations focus on Right Rate alone
- EEF’s, at the right rate, stand a better chance of achieving more desirable outcomes by better fulfilling 4R Nutrient Stewardship.