Smart blending of enhanced efficiency fertilisers to maximise sugarcane profitability

Application rates of nitrogen (N) fertiliser to sugarcane crops generally range from 130 to 250 kg N/ha, approximately half of which may be lost through gaseous emissions, leaching and/or runoff following large rainfall or irrigation events. The N losses not only impact upon environmental assets, but also substantially decrease farm profit.

Enhanced efficiency fertilisers (EEFs), such as polymer-coated urea (PCU) and nitrification inhibitor-impregnated urea, can increase nitrogen use efficiency (NUE). However, the N release pattern of PCU may differ from crop N uptake dynamics and the high cost of EEFs can impede their use by farmers.

Led by the Queensland Department of Environment and Science and involving four partner research organisations, this project aims to investigate optimal blending ratios of EEFs with conventional urea, under various soil and seasonal conditions.

The Research Questions

- Can fertiliser N application rates be significantly reduced by properly blending PCU and conventional urea?
- Can blended use of PCU and urea increase fertiliser NUE compared to using a single product?
- How much can farm profitability be improved from the use of blended fertilisers compared to the use of a single product?
- How to select the most suitable products and work out the optimal blending ratios for a specific farm?

Methodology

The following research is being undertaken using replicated on-farm field trials in the major sugarcane growing regions of Innisfail, Tully, Ingham, Mackay and Bundaberg:

- Different blends of commercially available fertiliser formulations (conventional urea, PCU, or nitrification inhibitor-coated urea) assessed at the recommended and sub-optimal rates.
- Soil samples collected and analysed to monitor ammonium and nitrate N dynamics and movement in the soil profile.
- Sugar yield and crop nitrogen uptake measured and profitability analysed to assess the most profitable fertiliser management strategies in relation to soil, site and seasonal conditions.

Project Achievements

- First year crops have been harvested across the six field research sites.
- Soil and plant samples were taken and analysed for mineral N and total N content.
- Field days, site tours and workshops have been conducted at sites by local partners for grower input and feedback.

Initial Outcomes

- The nitrification inhibitor (DMPP) increased ammonium (a stable mineral nitrogen form) accumulation and/or reduced nitrate (a mobile nitrogen form) accumulation in soil in the first 1-2 months after application.
- Mineral N release and accumulation from PCU were markedly slower than conventional urea in the first 3 months after application, which may potentially decrease N loss after rainfall.
- Significant movement of fertiliser N to deep soil (> 60 cm depths) were recorded in the normal urea treatment in well-drained soils. However, such movement was not evident in PCU fertiliser treatments or in poorly drained soils.
- Most fertiliser N that was released into soil disappeared within 2.5-3 months after application. The quick depletion of urea N (with or without DMPP) at the early crop growing season demonstrated the risk of substantial N loss.
- The above benefits of EEFs in conserving N in soil did not translate into significantly higher sugar yield in most cases in the first year. The research team are examining the long term performance of EEFs.

Photos: courtesy HCPSL, T.R.A.P Services & Marguerite White

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This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit program, the Queensland Government (Department of Environment and Science, Department of Agriculture and Fisheries) , Sugar Research Australia, Herbert Cane Productivity Services Limited, Farmacist Pty Ltd, ICL Specialty Fertilisers and Incitec Pivot Ltd

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