(Over top right) UAV multispectral imaging assisting research in understanding N uptake by sugarcane across the growing season. (Below) One of the Northern NSW trial sites.

RESEARCH PROGRAM TARGETING IMPROVED NUE IN SUGAR INDUSTRY

BY MARGUERITE WHITE

Sugarcane research into increased N use efficiency (NUE), and options for improved profitable use of N (N), have been the focus of three research projects of the More Profit from N (MPfN) Program.

The research effort has seen ten projects across the sectors of sugar, dairy, cotton and horticulture collaboratively generate greater knowledge and understanding of the interplay of factors that affect optimal N formulation, rate and timing, the contribution of soil mineralised N to the N budget of a crop, and how enhanced efficiency fertiliser (EEF) formulations can better match crop N demand.

For the sugarcane industry, three research projects have been led by the NSW Department of Primary Industries (NSW DPI), Queensland Government Department of Environment and Science (QDES) and the Queensland Department of Agriculture and Fisheries (DAF), financially supported by the Australian Government Department of Agriculture, Water and the Environment as part of its Rural R&D for Profit program, SRA and project partners.

In March, the projects were involved in a series of Fertiliser Australia workshops to extend the outcomes of their research directly to regional agronomists and fertiliser resellers.

They have also worked extensively with local productivity services organisations and agronomy consultants to conduct local trials and communicate the ongoing research at shed meetings, trial tours and industry service provider workshops.

This article provides a summary of one of the projects and future editions of CaneConnection will feature other activities in this program.

Project: The role of PCU and accounting for soil supplied N in NSW sugarcane

**NSW DPI, Chief Investigator: Dr Lukas Van Zwieten**

Partners: Southern Cross University and Sunshine Sugar

THE ISSUE

The Australian sugarcane industry is well aware of the ongoing need to develop and adopt sustainable production practices. As sugarcane has large production potential, N remains a key factor in driving productivity and profitability. However, crop NUE remains generally below 40-60 percent of applied fertiliser, with N loss pathways including nitrate (NO_3-) leaching and run-off, and through gaseous losses by denitrification.

OBJECTIVES OF THE RESEARCH

- To determine the extent of subsoil (deep) N reserves in northern NSW cane fields, both mineralised and potentially mineralisable N (PMN), to allow future refinement of the SIX EASY STEPS application rates.

- To develop new tools (mid infra-red (MIR)/ near infra-red (NIR)) to rapidly and inexpensively predict PMN in sugarcane soil.
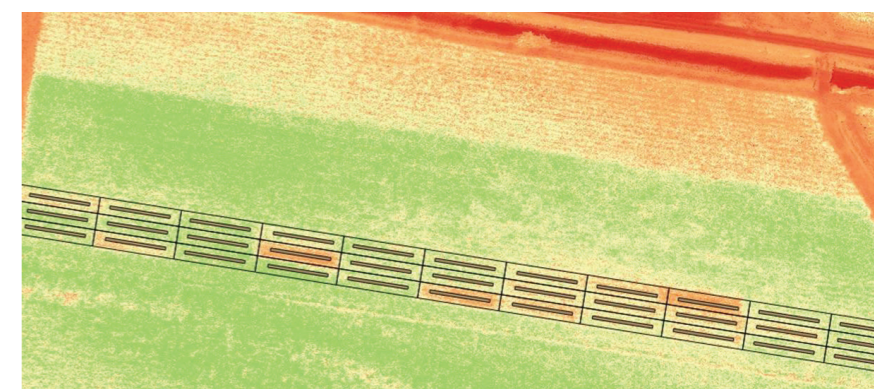
- To assess the potential of controlled release polymer coated urea (PCU) to better match soil N supply with crop demand, therefore benefiting yield in both one and two-year cane crops, by;

- delivering yield and N uptake response curves between urea and controlled release urea (5 rates) from 4 field trials.

METHODS

- 1m cores (3 per field) taken from 27 cane fields in NSW and analysed for Carbon, N, pH and mineral N as well as PMN at 0-20cm and 20-40cm.

- N release measured from PCU 90 and PCU 270 mesh bags placed on row, at stool splitter fertiliser placement depth, in a non-fertilised area over a 24 month period to obtain an N release curve.

- Four field trials conducted at Stotts Creek (Tweed Catchment), Pimlico and Coraki (Richmond Catchment) and Woodford Island (Clarence Catchment) to investigate PCU blend effect on yield and N leaf content (%) over time versus standard practice urea application.

- Unmanned Aerial Vehicle (UAV) multi-spectral imaging used to monitor plot performance. Green Normalised Difference Vegetation Index (GNDVI) is a vegetation index for estimating photo-synthetic activity and is a commonly used vegetation index to determine water and N uptake into the plant canopy.

OUTCOMES FOR INDUSTRY

- Some sugarcane farms in NSW have significant stores of N fertiliser (up to 300 units of N), being made up of mineral N and PMN prior to planting or the ratoon crop, allowing refinement of N fertiliser application.

- A rapid test based on MIR spectroscopy has been developed for NSW

sugarcane soils that can reasonably predict PMN across 14, 56 and 300 days.

- Results suggest minimal benefits of slow release PCU (either 90 day or 270 day release) in the dry years that the field trials were conducted. Better climate forecasting (particularly in-crop rainfall predictions) would enable farmers to make decisions on N application.

- UAV based multispectral imaging has assisted research trials on assessing crop N uptake throughout the growing season. GNDVI shows promise at 160 days after ratoon emergence for estimating leaf N content (and possibly yield). ∎

RECOMMENDATIONS

- **Slow release PCU is likely to have an impact where high rainfall directly after fertilisation results in loss pathways for urea. This needs a modelling approach to predict best response based on season, and better climate forecasting.**

- **Deep soil N and mineralisable N should be considered in calculating soil N supply to crop, with considerations within the SIX EASY STEPS.**

- **A better quantification of residual N in soil (after harvest) from PCU is still required. This would be taken into consideration with the above point.**

- **Because 56 and 300 day PMN are much greater than 14 day PMN (standard method), it would be an important step for industry to start looking more in-depth at whole season soil N supply.**