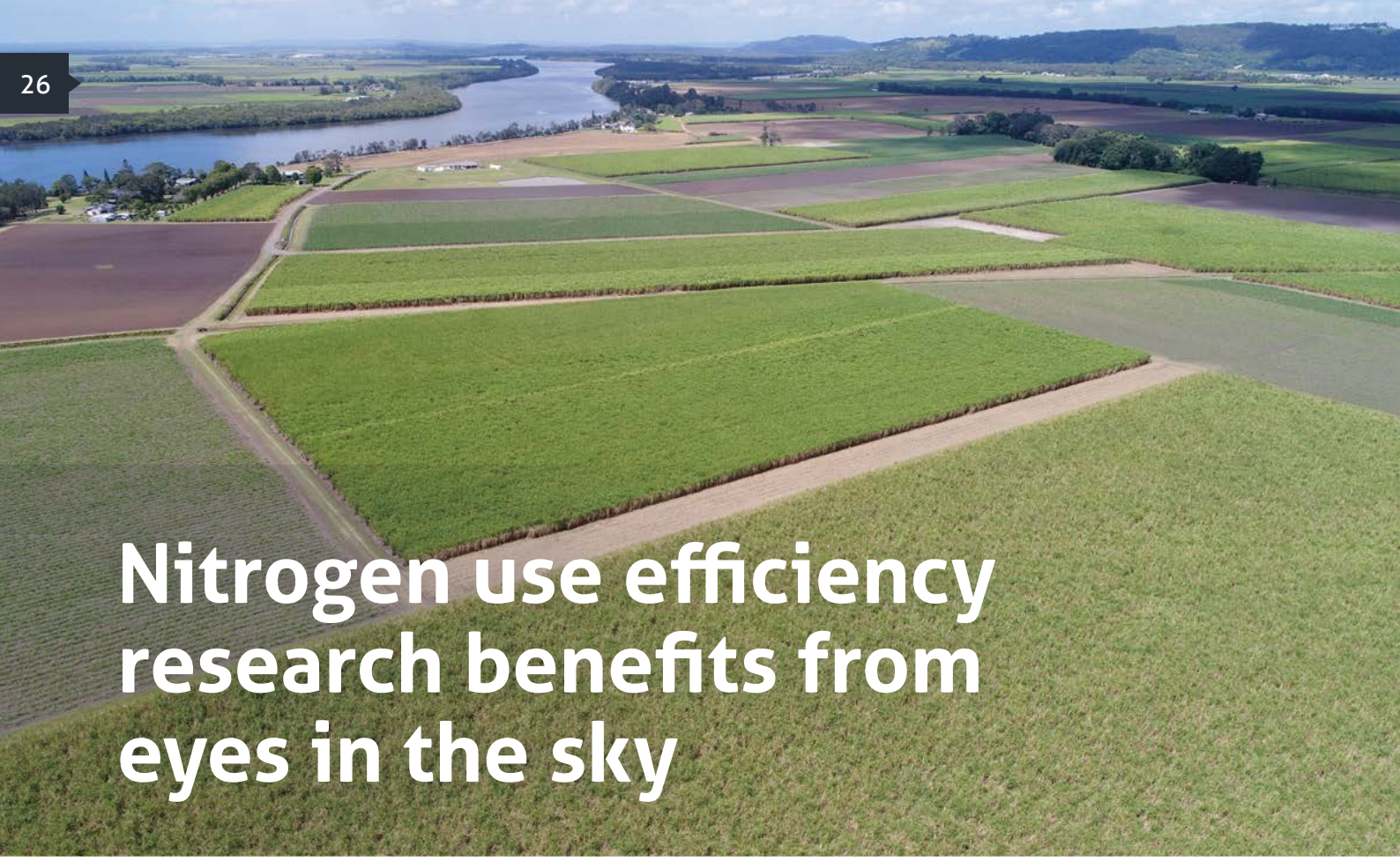


Nitrogen use efficiency research benefits from eyes in the sky

The NSW Department of Primary Industries (NSW DPI) is challenging the way in which N levels may be rapidly measured and monitored as part of their research on one- and two-year cane crops in the Tweed and Richmond catchments.

Over the past eighteen months, research has been underway to assess the nitrogen (N) stores in soil to improve understanding of N supplied from the natural breakdown of soil organic matter. It is also investigating optimal use of a 90-day polymer coated urea (PCU) enhanced efficiency fertiliser (EEF), to better match N supply with N demand from the crop.

The research is one of ten cross-industry projects seeking to increase nitrogen use efficiency (NUE) under the *More Profit from Nitrogen Program*, supported by the Australian Government's Department of Agriculture and Water Resources Rural R&D for Profit program and SRA.

The outcome of this research will be the development of a dose response and economic return model for traditional urea versus PCU, considering soil type and N supplied via mineralisation, so that growers can consider crop response and economic scenarios in making N fertiliser decisions.

The application of remote sensing technology is helping the research to tackle costly, time consuming and logistically challenging high frequency leaf sampling needed to observe N response to varying products and rates. The use of unmanned aerial vehicles – commonly known as drones – with multispectral imaging may sound futuristic, but its use in the research gives the industry an insight into how close this type of technology may be to more common grower use.

"This type of research is all about ground-truthing what we are capturing using the technology," said Josh Rust, NSW DPI's technical officer. "We have compared data from various indices captured by the imaging to traditional leaf N analyses take throughout the growing cycle and sugarcane yield at crop maturity."

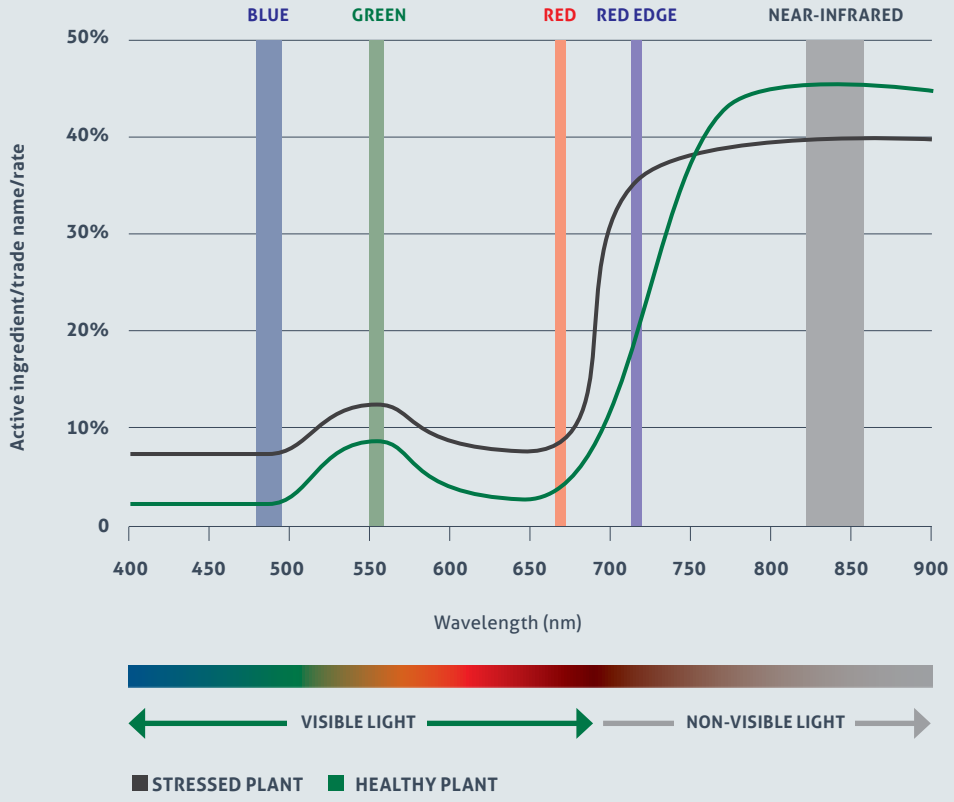
Spectral data is collected using a Micasense Red Edge™ 5-band camera fitted to a DJI M600 hexacopter. The camera captures images simultaneously at five discrete wavebands, effectively separating green, blue, red, near-infrared (NIR) and rededge, with data outputs enabling the team to test and optimise mathematical algorithms which will ultimately inform the N dose and economic response model for growers.

While the NSW DPI team view initial work as preliminary, there has been correlation found between reflectance (using Normalised Difference Vegetation Index (NDVI)) and field measured leaf N content. Team leader, NSW DPI's Lukas Van Zwieten, admits there are still "fine tuning" bumps to address.

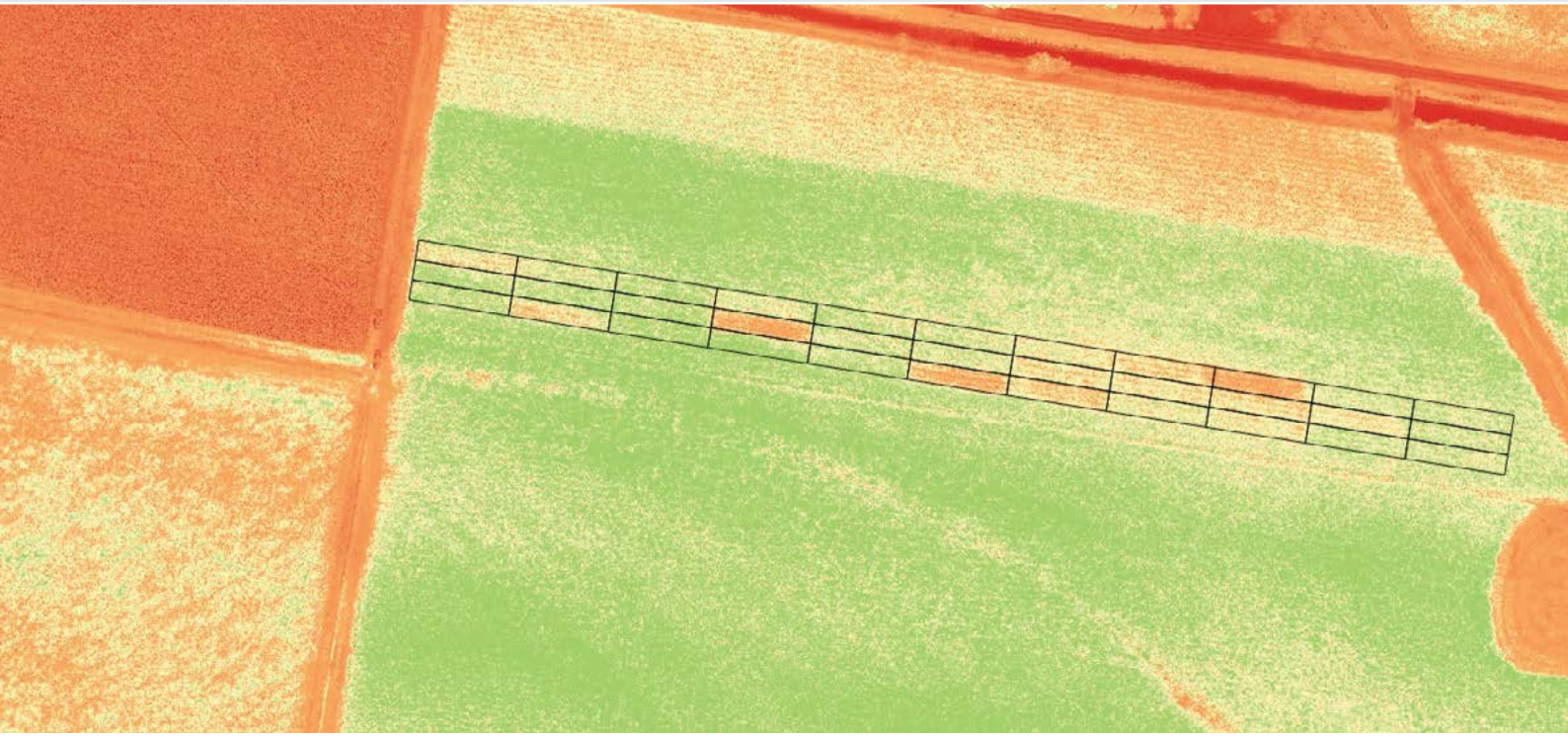
"We are investigating some alternative algorithms for reflective indices as we discovered NDVI was subject to saturation as the crop canopy closed. We also need to pinpoint analysis to account for small areas of reflectance from shadow, soil surface variability and buffer rows."

While the spectral data is being used at this stage to assist with research on EEFs, the technology also has potential to accurately identify areas in the field with other constraints limiting yield and fertiliser use efficiency. There is no doubt, however, that a future of accurately predicting in-field N stocks with remote sensing technology is drawing upon the industry and will only improve the precision in which EEFs are utilised and assessed for their economic returns by growers. ■

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, NSW Department of Primary Industries and Sugar Research Australia. It is also supported by research collaborators Southern Cross University and Sunshine Sugar Agricultural Services.



(Over page) *Richmond Catchment Trial Site - Northern NSW.* ***(Left)*** *By measuring the reflectance of a plant at different wavelengths, multispectral imaging enables identification of areas of stress in a crop, and provides a quantitative metric for the vigor of a plant. (image c/o Micasense).* ***(Below)*** *NDVI image of the EEF cane trial site in the Richmond Catchment Northern NSW (experimental plots overlayed). The trial is testing five rates of urea, five rates of the EEF 90 day polymer coated urea, and nil N control with three replicates in a randomised blocked design. Green indicates higher leaf N content.* ***(Bottom left) 1.*** *Micasense Red Edge™ camera.* ***(Bottom left) 2.*** *DJI Matrice 600 Pro Hexacopter.*



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