

Improved yield forecasting and N management through remote sensing

Advances in remote sensing technology – and research to apply it within the sugarcane industry – is hoped to deliver improvements to yield forecasting and nitrogen management for the Australian industry.

The Australian sugar industry could soon to take a big step forward in yield forecasting and access to derived crop vigour, yield and foliar concentration maps, thanks to research funded by Sugar Research Australia.

The research is looking at increasing the industry's access to remotely sensed data as well as establishing protocols that support its practical implementation into the sugarcane farming system.

Remote sensors, such as the images captured by satellites, provide a useful way of obtaining information about a cane crop even once it is difficult to physically access.

The technology is not new, but the research has worked on making it more practical and useful for the Australian sugarcane industry.

This project builds on previous research undertaken by the University of New England (UNE) and Farmacist, by developing remote sensing yield forecasting models that use historic growth trends as indicators of production in the future.

By taking snap shots of crop performance over a period of 15 years for example, this approach takes into account the direct crop response to many influences on seasonal production, including climatic variation.

"The benefit of this approach is you can collect an image in the early part of the year, and then use the model to receive a yield prediction in relation to variability within the region. This represents a big step forward compared to capturing just one single image to determine yield," Prof Robson said.

Coinciding with the improved yield forecasting models will be the automation of image processing and distribution of imagery products across the Australian sugar industry.

The project team, in conjunction with regional sugar mills, will focus on improving access of imagery data at the farm level. This information, provided monthly (depending on cloud) will provide growers with a greater understanding of crop variability.

This would support targeted agronomy and the adoption of precision agricultural practices. To assist with the interpretation of imagery products and its integration into a farming system, Farmacist is a project partner.

At a farm level, improved access to this information will assist growers and consultants to identify productivity constraints.

The benefits of this approach compared to harvester monitor yield data is that variations in crop performance can be identified during the growing season, therefore creating the opportunity to act and fix the issue.

Project details

Key Focus Area

Farming systems and production management

Project name (2016 project)

Sugar from Space: improved data access, yield forecasting and targeted nitrogen application for the Australian sugar industry

Project number

2016/062

Principal provider

University of New England / Farmacist

Project team

A/Prof Andrew Robson, Dr Moshir Rahman and Jasmine Muir (UNE), Tony Crowley, Rob Sluggett and John Markley (Farmacist)

Regionally and nationally, the project offers benefit to millers and marketers through improved yield forecasting, supporting more accurate forward selling decisions. Additionally, the development of yield maps at the regional level will provide mills with a better understanding of the variability of crop performance, which would assist with harvest scheduling and the rapid identification of reduced performance across sub-regions.

Over time, access to this data will provide an effective tool for identifying possible gradual declines in crop performance as a result of soil constraints or biosecurity outbreaks.

In addition to yield forecasting, the research is also looking at the value of using remote sensors as a tool for nitrogen mapping and as a research aid.

The potential to assess nitrogen uptake via images of the leaves has significant potential for the industry.

The current methods of assessing the N uptake of a crop are imprecise, expensive, time consuming and not always representative of the entire crop.

While there is significant research being conducted on the appropriate rates and form of applied Nitrogen, there has been little research developing protocols that assist growers in implementing the recommendations within blocks. This component of the project, conducted by Farmacist, will evaluate a range of commercially available vehicle mounted sensors and data collection processes that support the variable rate application of Nitrogen.

The success of the research over the last six years has led to a new SRA-funded project that commenced in 2016, which will see the research extended across the industry. There are currently 13 mill regions involved in the new project.

“We used multispectral satellite sensors as well as hyperspectral drone and field based sensors,” A/Prof Robson said. “This evaluation included a number of growing seasons, varieties, ratoons and regions including Tully, the Burdekin, and Mackay.

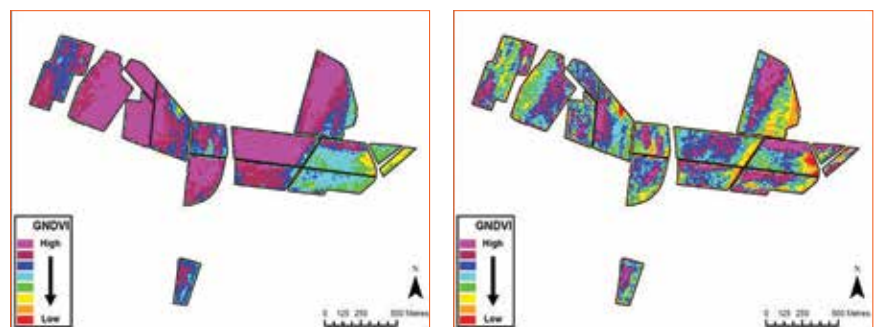
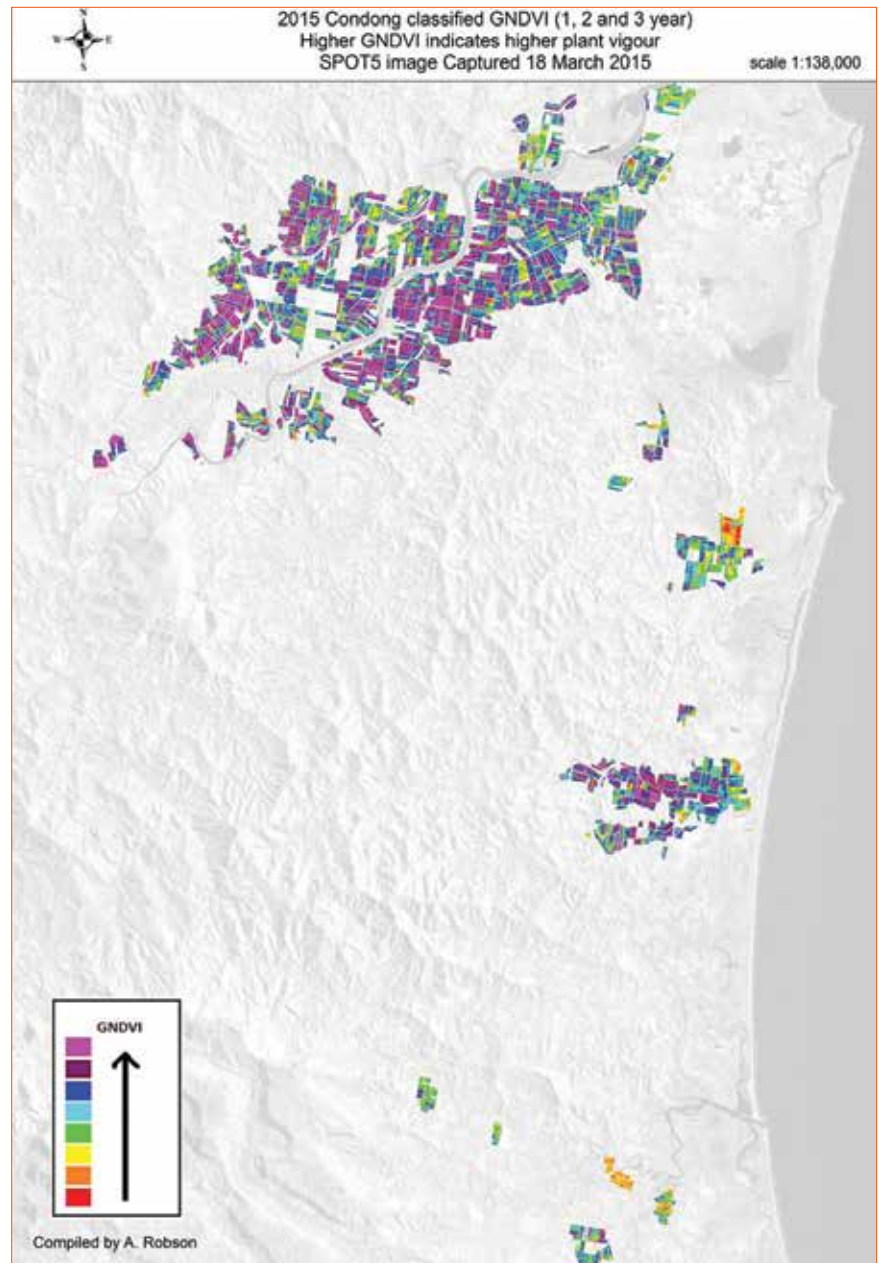
“The purpose of this was to determine if we could measure the foliar concentration of N, and determine which wavelengths of light we could use to discriminate from other changes such as pests, diseases, and biomass.”

With the new project, Farmacist will be leading research to determine the best commercial sensor that could be fitted to a tractor, as well as protocols to follow when linking the information from the sensor back to variable rate fertiliser application.

“This would support more appropriate precision application of fertiliser and support tools such as SIX EASY STEPS. Rather than having guidelines for a region, we can confidently apply our information to within a block.”

The new project will also be evaluating Sentinel satellite imagery which provides free imagery at 10 metre resolution and a current repeat time of around 20 days.

“Part of our research is to ensure that outputs are adoptable by industry. If Sentinel does prove to be useful, then this is a great step forward for the entire industry in terms of affordability’



Above: (Left) GNDVI classification of a sugarcane farm using the current approach i.e. 8 classes applied at the regional level. (Right) GNDVI classification of each individual block. SPOT 5 image (15th March 2015).

“Our next step is to automate the processing and distribution of imagery products: vigour maps of high, medium and low growth; a qualitative N map; and derived yield maps using the time series yield algorithms via the mills.”