Forensic agronomy

***Emma Leonard**, AgriKnowHow*

In many situations management practices are the main cause of in-paddock yield variability.

High resolution satellite images have highlighted that in-paddock variability is often the result of previous management practices.

There has been much focus on understanding the causes of in paddock variation. Queensland agronomist Tim Neale, CTF Solutions, has taken his investigation to the next level using high resolution satellite imagery. He acknowledges that it is not feasible to manage variability at a 1m resolution but this level of detail is required to understand the causes. In many cases he has found the variability relates to management rather than underlying soil or topographic causes.

Much satellite data used in precision agriculture has been based on coarse data. That is, each pixel that makes up the image represents large areas. For example, 25 metre pixel (625m^2) for a satellite image gathered from the LANDSAT or 10 metre (100m^2) from SPOT. At this resolution much of the variability is averaged out in each pixel and consequently masked (Figure 1).

High resolution satellite imagery provides pixel sizes of less than 2.5m (6.25m^2) and much more variability is seen.

it is not feasible to manage variability at a 1m resolution but this level of detail is required to understand the causes

Tim has been using high resolution satellite data with his clients for several years and has been amazed at how often the variation in a paddock is related to management or to factors not identified by other forms of imagery. From his experience the timing of data capture during the growing season is not crucial, as poor areas generally appear poor throughout the season.

Using data from satellites that provide 1m and 0.6m resolution images CTF Solutions has now captured over 850,000ha of high resolution satellite images across Australia.

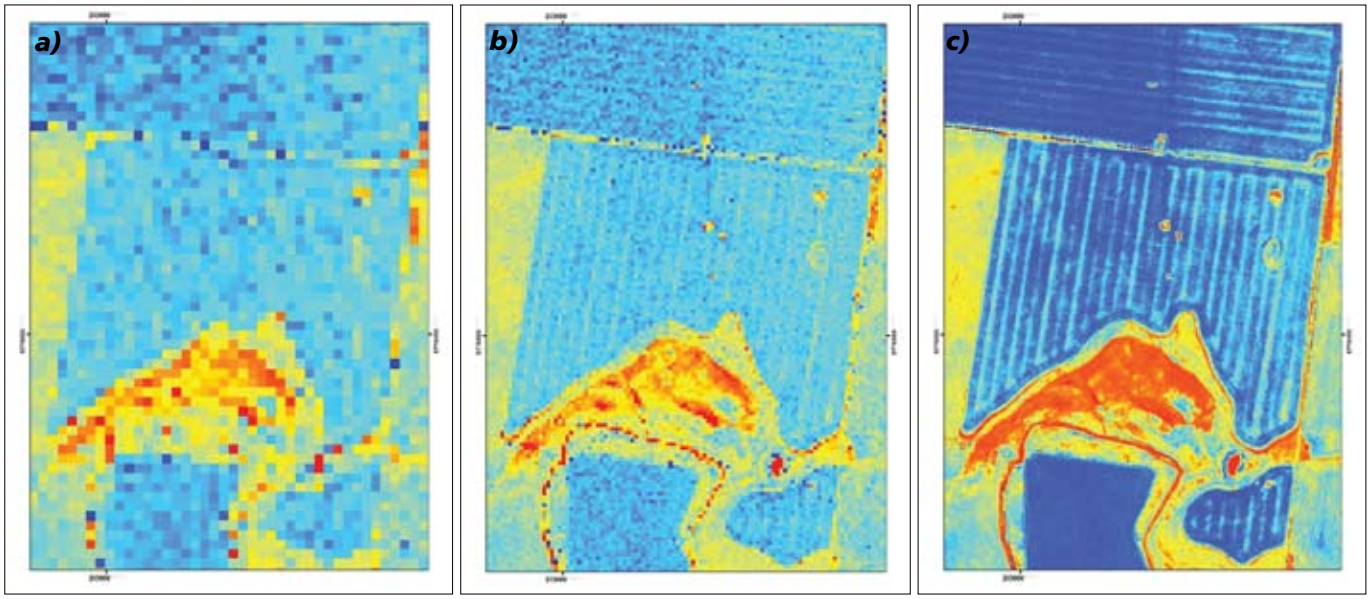
Four wavelength bands are captured allowing true colour analysis, so images can be delivered in a range of formats including looking like aerial photos or NDVI, within about a week of capture. At about $0.50/ha high resolution imagery has become cost effective (minimum areas are required).

The causes of variation being identified include poor calibration of fertiliser spreaders resulting in up to 50 per cent of the paddock being under fertilised, soil compaction caused by random traffic and poor plant vigour caused by uneven seeding depth/poor seeder set-up. Spray damage, variety differences, disease and insect damage have also been recorded. Paddock history and previous management such as header rows also clearly show-up in this high resolution data, and all have considerable effects on crop productivity.

Disease has also been observed using these images. An NDVI analysis of a

Satellite Imagery

Figure 1. The level of detail that can be obtained from satellite images gathered at different resolutions a) 25m pixel (625m²) LANDSAT, b) 10m (100m²) SPOT, c) 1m pixel (1m²).



high resolution satellite image, which indicates the biomass production of an area, identified small areas of very poor growth in a barley crop in Victoria. On the ground these areas were found to be between three and four metres diameter and were hotspots of the root disease Rhizoctonia. Prior to the analysis these areas had not been identified and the information was used to modify future rotations.

CTF Solutions has found high resolution images are valuable when identifying areas suffering from poor drainage. In 2004, a high resolution image of a 400ha paddock in Central Queensland was converted to NDVI, which highlighted substantial variability (Figure 2a).

Ground truthing confirmed that much of the variation related to water logging. The image was combined with a high definition topography map and the two data sets were used to identify the best options to drain the paddock. Yield variability was substantially reduced and total paddock yield increased (Figure 2b). The benefits of $5000 invested in drainage work were returned in 2006, which experienced a very wet winter, when yield income increased by $53,000.

Tim acknowledges that proximal sensing allows a grower to gather data and use data from a paddock at a specific time. However, until systems cover a greater proportion of the paddock he believes there is great value to be obtained from the high resolution satellite imagery. As with all remotely or proximally sensed data, on-ground truthing is essential.

For more information

Tim Neale,
Director, CTF Solutions.
0428 157 208
tim@ctfsolutions.com.au

Figure 2. High resolution images converted to NDVI highlighted considerable paddock variation (a) that was substantially reduced following drainage (b).