COMBINING AERIAL SURVEY AND GROUND TRUTHING TO ESTABLISH PLANT HEALTH

How Technology is Playing an Important Role in Identifying Nutrient Need

Authorised for release by :

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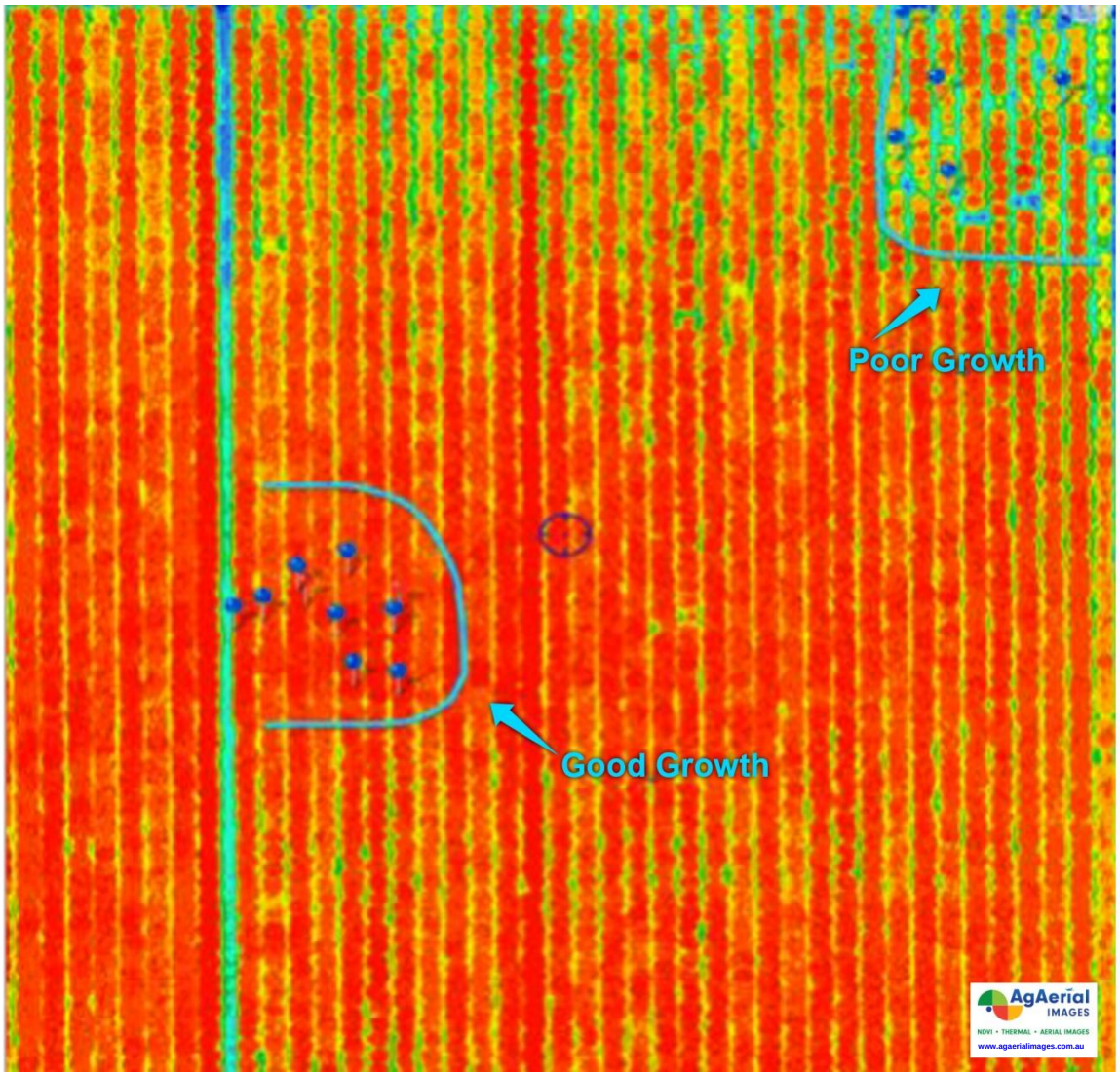
A recent collaborative case study was undertaken between Richard Stone, RLF's NSW Field Operations Manager and Peter Borella, Director, Agaerial Imaging using a drone to identify the health of an almond tree orchard at Griffith, NSW Australia.

This was conducted during January and February 2018. The technology used to create the detailed mapping images in this article is called Normalised Difference Vegetation Index (or NDVI). The images were created using a fixed wing drone flying at 400 feet.



Richard Stone conducted a ground truthing investigation to establish the cause of the poor growth as indicated by the NDVI map above.

What is NDVI?

Normalised Vegetation Index (NDVI) quantifies vegetation indices by measuring the difference between near-infrared light (which vegetation strongly reflects) and red light (which vegetation absorbs). Healthy vegetation contains chlorophyll and as such reflects more near-infrared and green light as opposed to other wave-lengths. But, it absorbs more red and blue light making this the reason why we see vegetation as the colour green.

So overall, **NDVI** is a standardised way to measure the health of vegetation. When the **NDVI** indices are high (0.8 – 1.00), the crops are healthier. When the **NDVI** indices are low (0.3 - 0.5), the crops are adversely effected.

By visiting the varied colour and NDVI indices's values reasons for poor growth can be established.

What is Ground Truthing?

Ground truthing is the process of collating and interpreting the information that was collected from the aerial imaging. It enables the image data to be related to ground features, and this is becoming an important diagnostic tool for the site-specific management of crops. The reflected light images are useful for detecting crop stress – often whilst there is still time to correct the problem. If you want more information about Ground Truthing contact rstone@rlf.com.au.

The Ground Truthing Summary for the Almond Trees

The almond trees located in the poor growth area as demonstrated in the aerial image showed much less vigour and nut development than those in the good growth area.

The soil test results taken from the poorly performing area showed elevated sodium levels in the soil, as well as elevated levels of nitrate, phosphorous and sulphur. This indicates that the trees in this poor area, (due to the excessive sodium levels) were not performing as well as the good growth areas because they were not extracting the nitrogen, phosphorus and sulphur from the soil. Leaf tissue analysis further confirmed that the poor growth trees had four times less nitrate in the leaves than those of good performing growth.

Soil tests taken from both the good and the poor performance growth areas are as follows:

	Soil Test Results	Leaf Tissue Results
Nitrate nitrogen mg/kg	**38** (poor growth) **8** (good growth)	**49.05** (poor growth) **192.56** (good growth)
Phosphorus Colwelll mg/kg	**90** (poor growth) **43** (good growth)	
Sulphur mg/kg	**232.5** (poor growth)	
Exc. Sodium meq/100g	**2.90** (poor growth) **0.88** (good growth)	

Subsequent to the NDVI and ground truthing investigation and explanation of the patchy performance of the almond trees, the grower expressed interest in a foliar crop nutrition program to alleviate the deficiencies highlighted.

The Way Forward

Richard Stone provided a more detailed summary of the almond crop as follows:

"The almond grove area has just received 8 inches of rain recently and is also irrigated. The grower was unable to apply nutrients by ground, so is considering applying by helicopter which he believes will tend to force the spray into the canopy better, and be able to apply nutrients to individual areas easier. Bearing in mind that the trees are approximately 4 metres high, this seems a logical application method for foliar fertilising at this time.

The almond nuts are about 3 weeks off the shell-splitting stage and will be harvested mid-February (2018)".

Information was then sought from Dr Hooshang Nassery, RLF's Plant Physiologist and Head of Technical about the crop nutrition program, water and wetter rates for helicopter application. His response and recommended fertiliser program are as follows:

"While the leaf analysis established that the good growth area had optimum levels of potassium, the poor growth area showed deficient levels of potassium. The leaf from the poor growth area had higher sodium levels (to make up for potassium deficiency).

The soil data, and the following figures from the soil report confirms the leaf analysis results.

Soil Data	Good Area	Poor Area	Guide
Ca:Mg ratio	2.5	1.8	3 – 6
Exchange Na%	0.8	2.9	<1
Exchange K%	1.07	1.11	1 – 5
Nitrate-N	8	38	
Ammonium-N	1	4	
Zinc	6.58	4.63	5.5 – 6.5
pH Ca Cl2	5.7	5.5	5.5 – 6.5

The low potassium in the leaf tissue of the poor growth area is due to high sodium in the soil which is also associated with the lower Ca:Mg ratio in poor growth area. As the poor area growth is not as good as the good area, utilisation of nitrogen is not as efficient as the good growth area, therefore nitrate and ammonia accumulate in the soil".

Fertiliser Program Recommendations

Foliar Application

Use **AcetaK** potassium after the fruit set and during nut growth to the poor growth area (with 2 applications), and the good growth area during nut growth (1 application).

Soil application

Use **AcetaK** potassium or **KC30** as fertigation to poor growth area to increase soil-available potassium.

The zinc level is adequate in both the good and poor growth areas, however it is advisable to use 5L of **Plasma Power** per hectare as foliar across the entire grove to improve trace element levels. This will also assist with available phosphate during nut growth.

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