On-the-go protein mapping

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TECHNOLOGY within the agricultural industry has developed rapidly in the past 10–15 years. Investment into modern and large scale farming will continue as farmers strive to increase yield and profitability. Precision agriculture will be a key driver in developing technologies to give farmers the data and tools to farm smarter and more efficiently.

Near infrared analysers have been used at bulk handling sites across the country to measure protein, oil and moisture in whole grains for many years. In the past 15 years, farmers have started using on-farm NIR analysers to test their grain prior to delivering or storing. In the past few years, these NIR analysers have been adapted to fit on a combine harvester in order to collect protein, oil and moisture data as the grain is stripped.

CropScan 3000H remote sampling head mounted to a Case combine.

A local instrument manufacturer, NIR Technology Systems (now Next Instruments), developed the CropScan 3000H On Combine Analyser that provides farmers with real time moisture, oil and protein measurements. From this data, on the go maps can be generated.

Importance of on-the-go protein maps

In Australia, the prices paid for wheat and barley are based on the protein content as well as hectolitre weight and per cent screenings. But in most other countries, crop payments are not graded by protein content. Nonetheless nitrogen based fertilisers are used throughout the world to increase yield and/or protein content.

Protein paddock maps are therefore important as a means of implementing variable rate fertilisation in order to level out the yield and protein content of the grain across a paddock.

The protein map – combined with a yield map – provides a distribution plot of how much nitrogen has been removed from the soil during harvest. This information can then be used to vary the rate of distribution of fertiliser for the next year's planting.

In order to generate protein paddock maps, an on combine analyser using NIR technology is required. An analyser that collects data at regular intervals across the paddock – along with GPS coordinates – provides a means of displaying real time paddock maps for protein, oil and moisture.

2015 harvest data

By the end of 2015, there were approximately 50 on-combine analysers installed in Australia, the United Kingdom and the US.

The experiences of farmers across Australia are varied. In some

FIGURE 1: Protein, yield and overlay maps, Bennington Pastoral Co, 2014 harvest

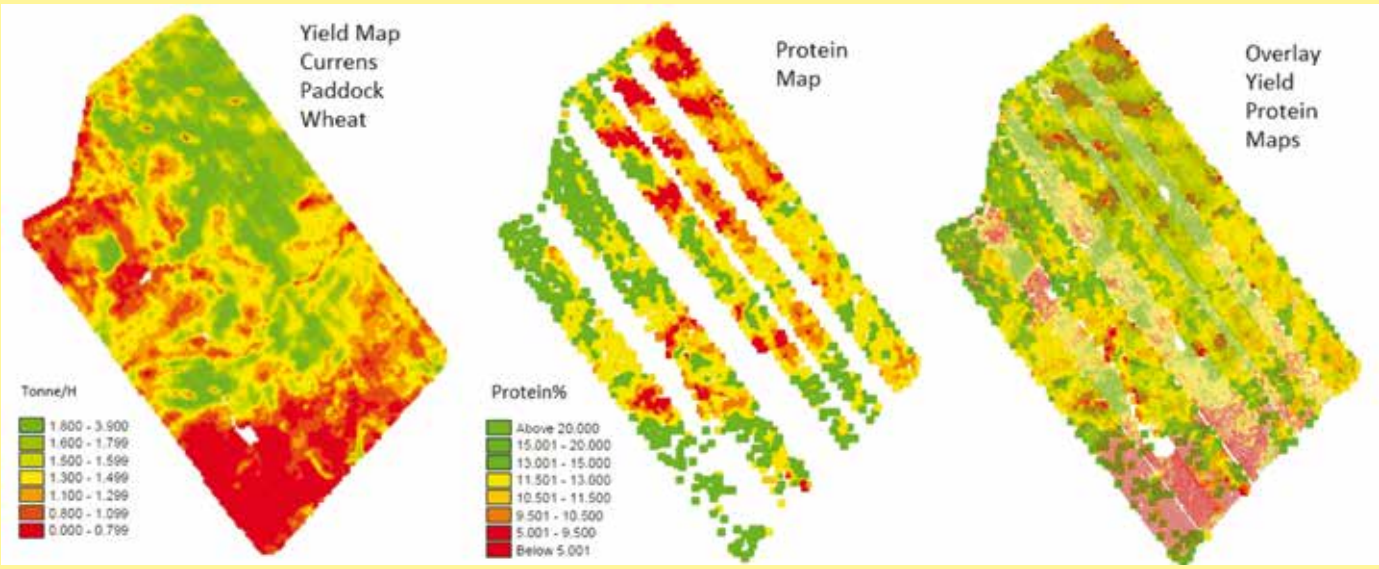

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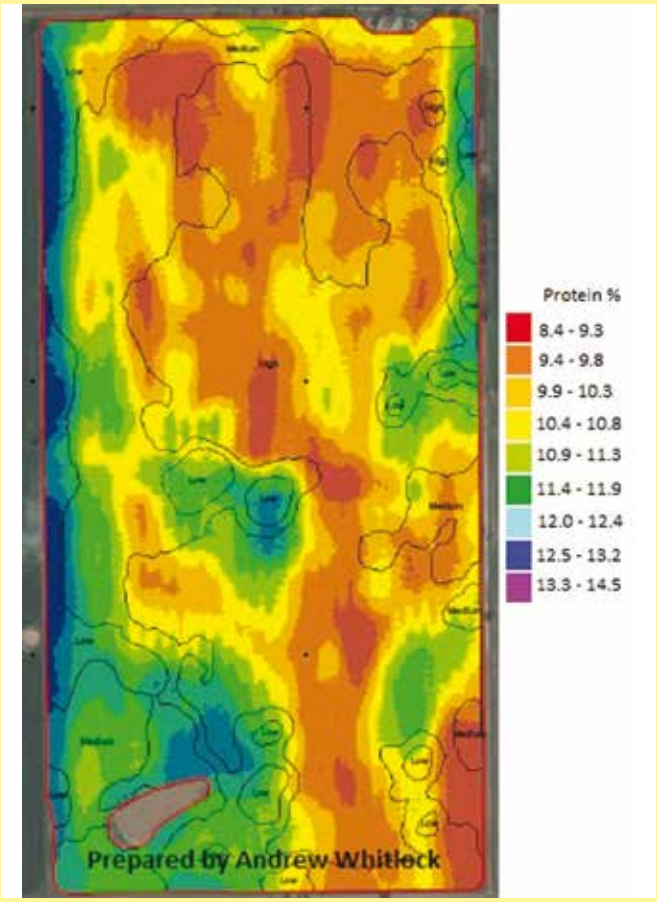
FIGURE 2: Protein and yield map, Grandview



locations the dry spring conditions meant that grain screenings were so high that the farmer could not use the protein data to segregate grain. But in other areas, farmers used the data to blend grain in the paddock and to create paddock maps in real-time and post harvest.

The following two case studies outline how on the go protein mapping can be of real agronomic and financial benefit

Luke Follett, Bennington Pastoral Company, Lake Benaneen, crops approximately 8000 hectares in the far south western region of New South Wales.

The Folletts operate two Case combines and grow wheat, barley, canola and lupins. They installed a CropScan 3000H into one header in 2013. Figure 1 shows protein and yield maps for one of Luke's paddock for wheat during the 2014 harvest.

Because only one header had the CropScan 3000H installed, there are strips in the protein map where the second header operated without collecting any protein data.

The overlay of the yield and protein maps shows the expected relationship between low yield/high protein and high yield/low protein. As such the correlation between the yield map and the protein map is very high.

There are areas in the paddock where the protein and yield are both mid level – for example the yellow zones. An increase in nitrogen fertiliser maybe effective in increasing yield and protein in these areas of the paddock.

An important observation from the protein map is that Luke could choose to blend the grain in the paddock by selectively stripping the red area and combining with grain from the green areas to raise the grade from ASW to APW. In effect, a $30 per tonne increase in grain price.

Adam Inchbold, HR&C Inchbold, Yarrawonga, crops wheat, barley and canola across 2500 hectares in northern Victoria.

The Inchbolds operate a New Holland CR series combine. The CropScan 3000H was fitted three years ago. Figure 2 shows a combined yield and protein map for the Inchbold's Grandview paddock where Trojan wheat was grown in 2015. The yield zones are shown as text within a black boundary. The protein values are shown as colour contours on the map.

The central zones – red, orange and yellow – show low protein and high yield. The bottom left zones show areas where there is high protein and low yield. This pattern follows the inverse relation that commonly exists between protein and yield.

But in the bottom right corner, the yield is low and the protein is low. Either more nitrogen was required in these zones or there are other limiting factors involved, such as moisture or soil.

"You can see significant variation in protein," Adam said, "and certainly enough to take the harvested wheat from ASW to APW in places. Unfortunately I do not have a nitrogen offtake map for this paddock. I think it is fair to say there is a trend to yield and protein having an inverse relationship, which will reduce variation in N offtake. But I would still expect N offtake to be interesting in terms of variable rate nitrogen application."

Although further statistical analysis would provide greater insight into what is happening in this paddock, around 50 per cent of the paddock is producing wheat of ASW grade, whereas the rest of the paddock produces APW to AH1.

The Inchbolds were able to segregate the grain and then blend to ensure that all loads met at least the APW grade – which realised an extra $30 per tonne across the paddock.

Significance maps

Brett Whelan, Sydney University, Precision Agriculture Laboratory, has used on the go yield and protein data to present 'significance' maps in three colours – for example red, green and blue. Figure 3 is an example.

The red areas are where an increase in nitrogen would increase yield and protein. The green areas are most likely producing an optimum yield and protein. The blue areas represent land that is suffering from lack of moisture or there is some other problem in the soil. In these areas, the source of the problem needs to be addressed rather than waste money on more fertiliser. ■

FIGURE 3: Significance map