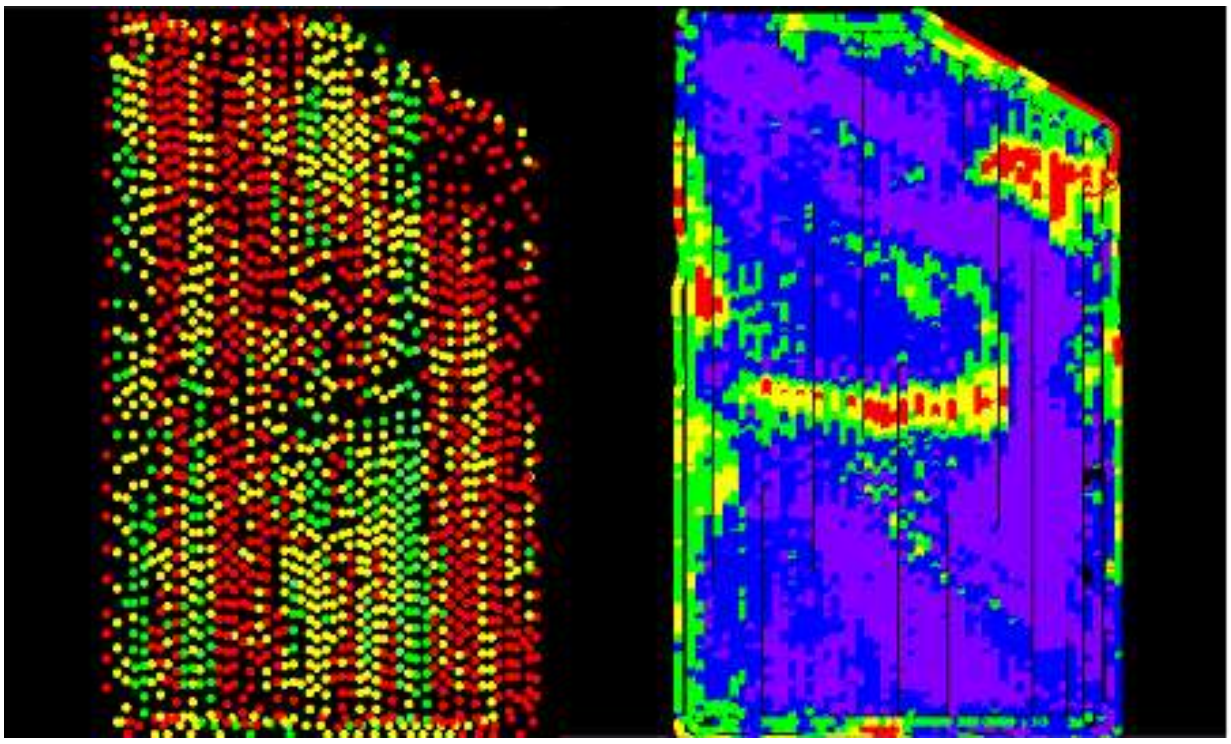
Six Benefits of using an On Combine Analyser to generate Protein Maps and combining the data with Yield Maps:

1) Monitor grain quality at a high spatial density

The CropScan 3000H provides data at approximately every 17meters down the paddock. In comparison to taking 5 in field samples and analysing them using a benchtop NIR, the CropScan 3000H provides a comprehensive picture of what is happening across the paddock.



Protein Map Yield Map

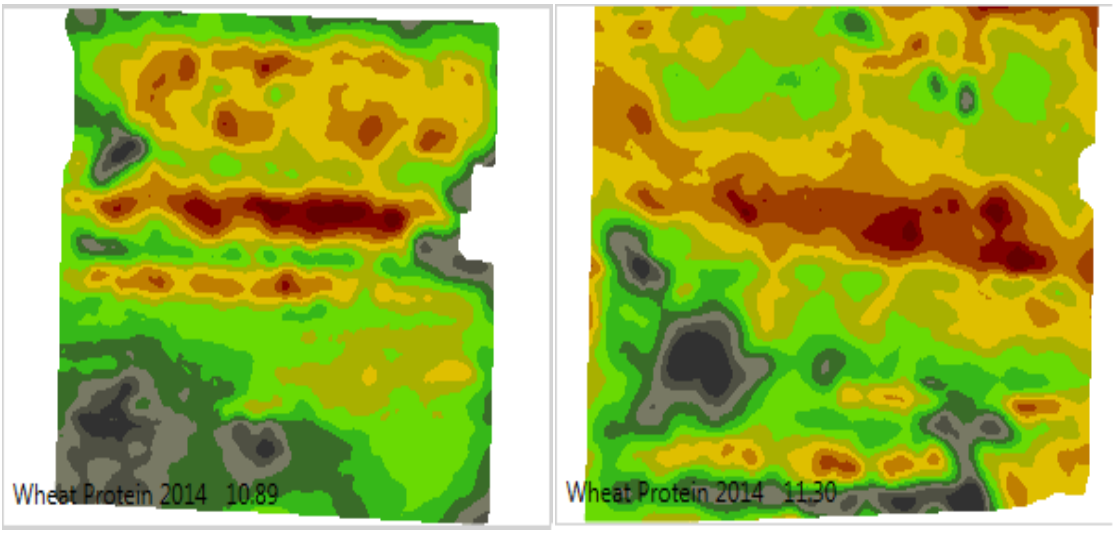
The CropScan 3000H measures Protein and Moisture in cereal crops such as wheat, barley, oats and sorghum as well as Protein, Oil and Moisture in oil seed crops such as canola. Data is collected at approximately every 11 seconds as the crop is being stripped. On average, this means data is collected at a rate of 15 measurements per hectare. This high special density data for Protein provide a means of generating Protein Maps, Nitrogen Removal Maps and Gross Margin Maps.

2) Differential harvesting and storage based on quality

The fastest return on investment from using the CropScan 3000H comes from in paddock segregation of crops. Additional profit can be generated by differentially harvesting the paddock, ie, harvesting sections of high protein grain in order to blend with low protein grain, and thereby capture a price increase by moving to the next grade. Alternatively the operator can use CropScan 3000H bin average data to direct loads into separate storage locations in order to capture the best quality grains and to blend post harvest. The following data was provided by Ashley Wakefield, Tingara, Urania, SA who crops wheat, barley and canola on the York Peninsula.

Profit Increase from In Paddock Blending

- **Paddocks 221A & 221B**
- **Total area 185ha**
- **Average Yield = 4.5t/ha =832.5t**
- **Top Half of each paddock was reading below 10.5% protein**
- **Bottom half of paddock was reading above 10.5% protein**
- **By blending we delivered 17 out of 18 truck loads as APW grade over ASW**
- **Increased Profit by blending:**
- **= $6900 $37.29/ha**

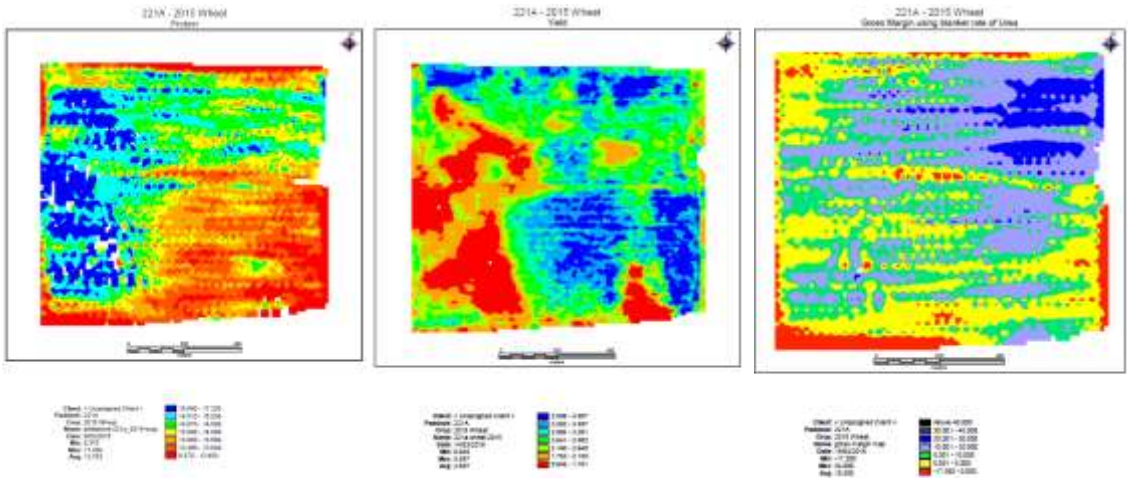


The data above shows where the grower used the CropScan 3000H Protein data to segregate bin loads into two field storage bins. The wheat was blended in the paddock from the two bins to ensure that truck loads taken to the silo were graded as APW (Protein >10.5%) rather than some loads graded as ASW (Protein <10.5%). The price difference was $30 per tonne between ASW and APW. Out of the 18 truck loads delivered to the silo, 17 were accepted as APW. Historically the grower would have expected half to go ASW and half APW. The net result was an additional $6900 generated from this paddock by blending based on protein.

3) Protein, Moisture and Yield Maps enable creation of true site specific Gross Margin Maps

By creating a Gross Margin Map of paddocks, then farmers can see if they are making money or losing money across their paddocks. There may be sections of the paddock where the margin is negative. This may lead to some corrective action or to changes in the paddock boundaries or cropping schedules.

The Gross Margin was calculated based on the Yield and the price of wheat as the Protein content increases. Protein, Yield and Gross Margin Maps are shown below.

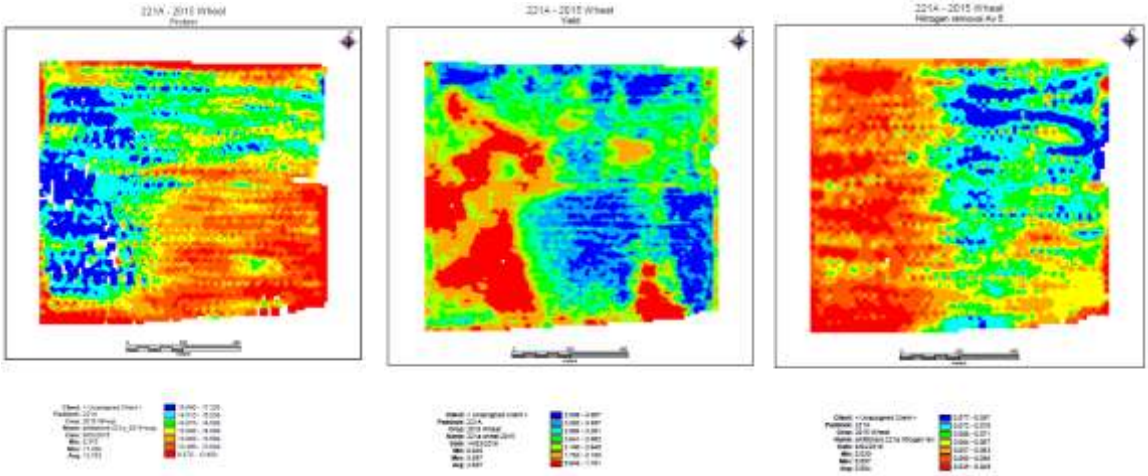


The Gross Margin Map shows that in the Red areas, the grower is losing money. In the Yellow areas, the margin is between 0 and $5 per hectare. Progressively the margin is increased from Green ($5 to $10), Pale Blue ($10 to $20), Blue ($20 to $30) and Purple ($30 to $40). The total profit generated on this paddock was calculated to be $29,329, however the potential profit would have been $33,164 if the Red areas had not been sown. A more practical approach would be that some remedial action be taken to ensure that the Red areas do not cost the grower money in the future.

4) Nitrogen Removal Maps are used in mass balance fertiliser requirement calculations

Using a simple formula: Nitrogen Removed = Yield * Protein% * 17% Nitrogen/Protein a Nitrogen Removal Map can be created from a Protein Map and Yield Map. Understanding that at the minimum, the same amount of Nitrogen that has been removed from the soil needs should be replenished using fertilizer, then the farmer can to develop a Variable Nitrogen Fertilization (VNF) program for next year based on the Nitrogen Removal Map. The possible savings in using VNF over blanket fertilization are between -22 and 39% depending on the paddock and the blanket loading of Urea.

Data collected from a 185 hectare paddock, York Peninsula, SA, 2015 harvest, compares the costs of Urea loading using blanket rates of 40, 56, 60, 70 and 80 kg per hectare vs using the Nitrogen Removed to apply urea. The Protein, Yield and Nitrogen Removal maps are shown below.



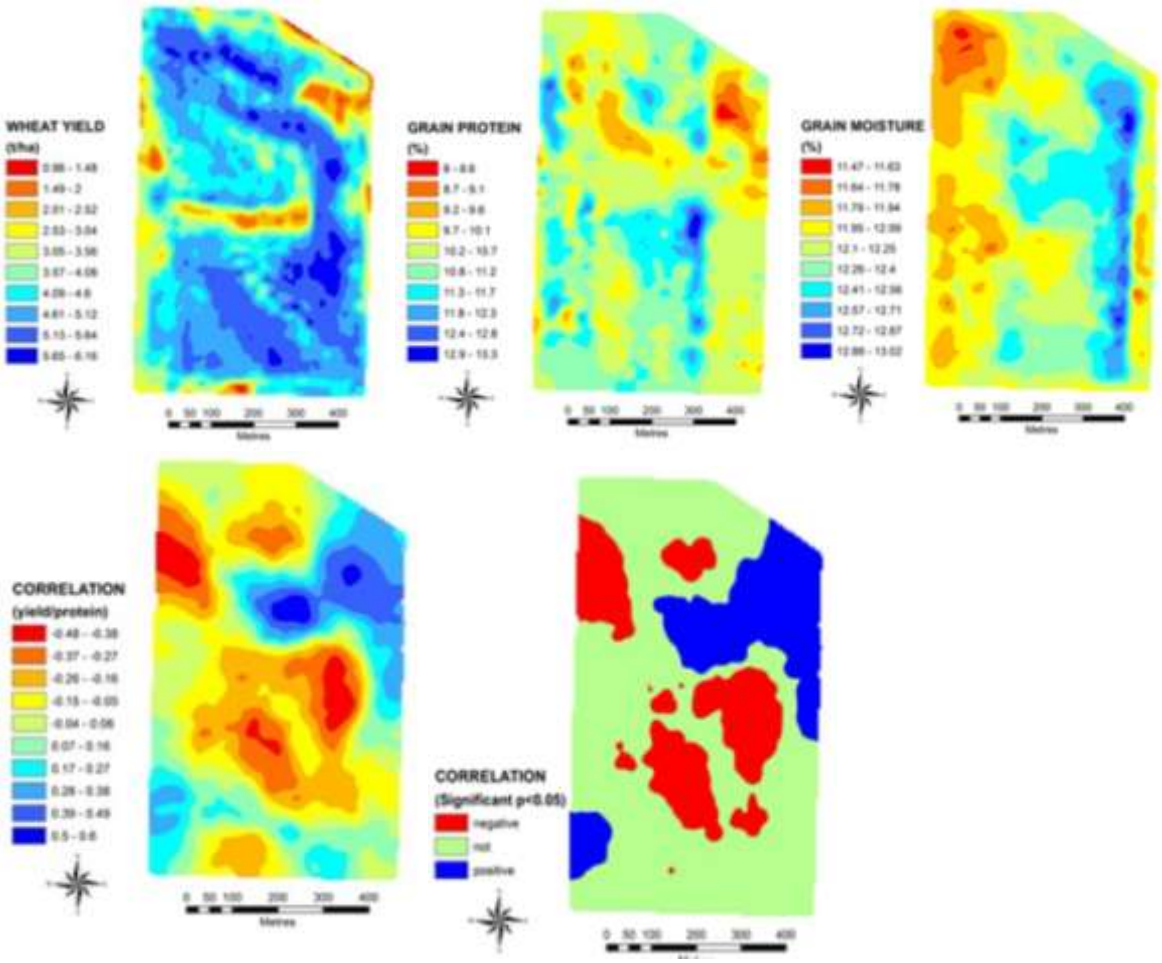
Protein Map Yield Map Nitrogen Removal Map

Based on a price for Urea of $430/tonne and a ratio of Nitrogen in Urea of 47%, the cost of the Urea loading was calculated. The table below shows the savings of using the Nitrogen Removed vs blanket rates.

$ Urea based on Nitrogen Removal	$ Urea based on 2.0T Yield	$ Urea based on 2.8 T Yield	$ Urea based on 3.0 T Yield	$ Urea based on 3.5 T Yield	$ Urea based on 4.0 T Yield
$10,632	$8,710	$12,194	$13,065	$15,243	$17,420
Savings	-$1,922	$1,562	$2,433	$4,611	$6,789
$/H Saved	-10.4	8.4	13.2	24.9	36.7
% Savings	-22%	13%	19%	30%	39%

5) Overlaying Protein and Yield maps with other data for better diagnostic insights into availability and uptake of Nitrogen

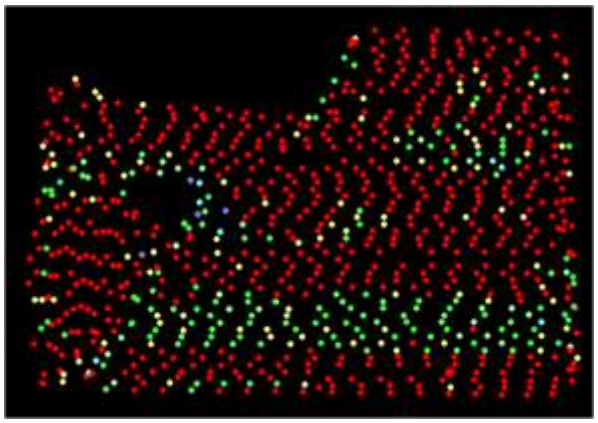
The Dilution Theory suggests that if the Yield is high then the Protein will be low. This may not always be the case and soil and moisture may be the limiting factors rather than Nitrogen availability. By overlaying the Protein and Yield Maps and computing a Correlation Map and a Significance Map, then simple Green, Red and Blue Zones can be identified.



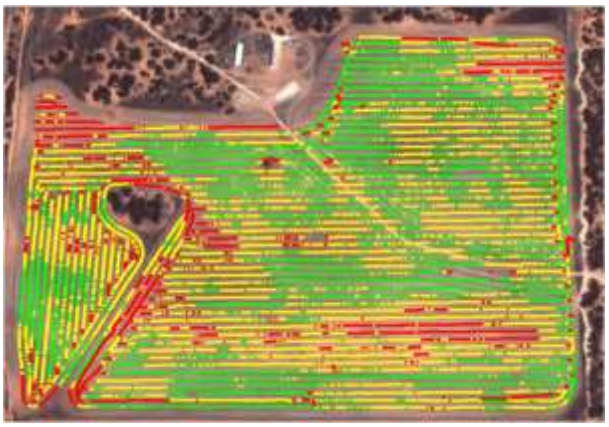
Green is where additional fertilizer will probably not result in significantly higher yields and protein. Red is where additional Nitrogen should realize an increase in both protein and yield. And Blue is where there are other problems effecting the crop, ie, soil, pH, moisture. In the Blue areas, the grower should consult his agronomist and get soil samples tested or even dig a pitt to get an understanding of what is occurring in these areas.

6) Full impact of N trials and VRF applications can be measured

Many farmers run field strip trials for Nitrogen, Phosphorous, Sulphur and other nutrient. The CropScan 3000H can provide data which can show the real impact and effects of the strip trials. By combining the Yield and Protein data, the farmer can quantify the benefits of making changes to their fertilization plans or even the varieties of seed they plant.



CropScan 3000H Protein Paddock Map



Yield Map

The Protein Map shows a green strip where a new fertilizer was laid. The Protein Map shows that the new fertilizer increased the protein content, however the Yield Map shows that the additional fertilizer reduced yield. The reduced yield offset the incremental price of the crop due to increased protein. The farmer concluded that this new fertilizer was not of benefit to him.

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