Satellite Imagery and Yield Mapping on CTF farms – What's Next?

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INTRODUCTION

With CTF and tractor guidance providing enormous improvement in farming systems, many of our clients were asking "what is the next step/leap"? As part of our GRDC funded project, ***CTF Solutions*** evaluated other new technology to increase dryland grain production profitability and sustainability.

After 4 years of research, with 50 co-operators across Australia, successful new technologies include **topography mapping (from 2cm RTK GPS), yield map interpretation, and high resolution satellite imagery**. Other technologies (EM mapping, VRT, PA management zones) were much less successful.

TOPOGRAPHY MAPPING

Topography mapping is basically the collection of height/elevation data using RTK GPS (the same system that is used for guiding tractors). The intense field data collection is made easier by using a 4WD. Once collected ***CTF Solutions*** analyses the data using a GIS to produce contour maps, elevation maps and slope maps.

The maps are then used to identify problem areas and design layouts for drainage, waterlogging and erosion control. They can be overlayed with other data such as imagery, soils, yield maps or farming operations.

The picture below (Figure 1) shows 10cm contour lines overlaying high resolution (1m pixel) satellite imagery. Areas of poor drainage are shown in dark colours, which are reflected by the topography lines. Drainage works costing $5,000 are generating an extra $50,000 production each year.

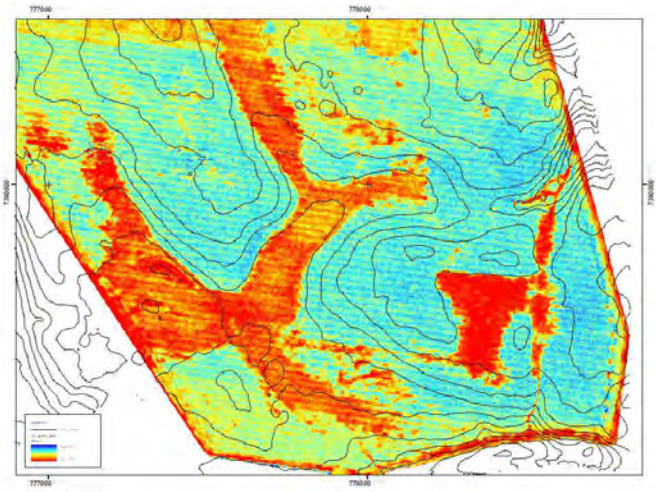


Figure 1

YIELD MAPPING

Yield maps have been around for some time. But only a few grain growers are collecting yield data and even fewer are making any sense of it. Because CTF and 2cm guidance ensures that the header comb is always full, the quality of yield maps is maximised.

The yield data below (Figure 2) is from round and round harvesting – not CTF. The darker areas are an artefact of the harvesting, not the actual yield. This is difficult to remove from the data, and any further analysis is flawed.

Figure 2

Figure 3 (below) is yield data from a CTF system with guidance. The even spacing of the data ensures its integrity, and any further analysis is valid.

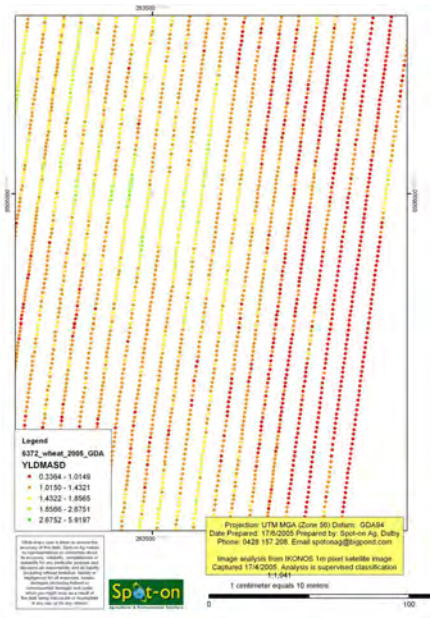


Figure 3

CTF Solutions has developed techniques to overlay yield maps from a number of years to produce **'yield stability' maps**. This helps identify where the most yield variation is, and to understand what is causing the variation. We also know now that there is significant value in properly evaluating your yield maps every season, rather than just filing them for a rainy day!

The yield stability analysis (Figure 4) highlights a significant problem in the bottom part of this paddock. The darker areas are yielding approximately half as much as the lighter areas in the top half of the paddock (3 years of data).

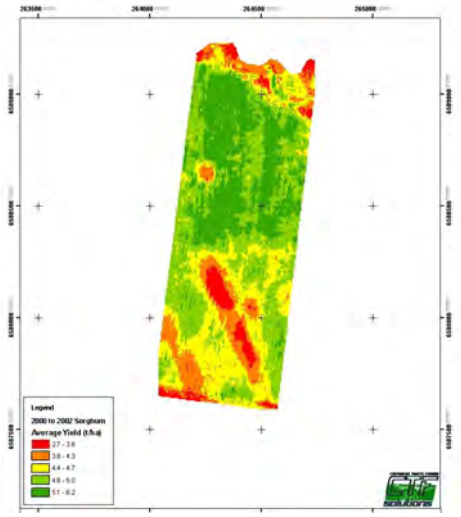
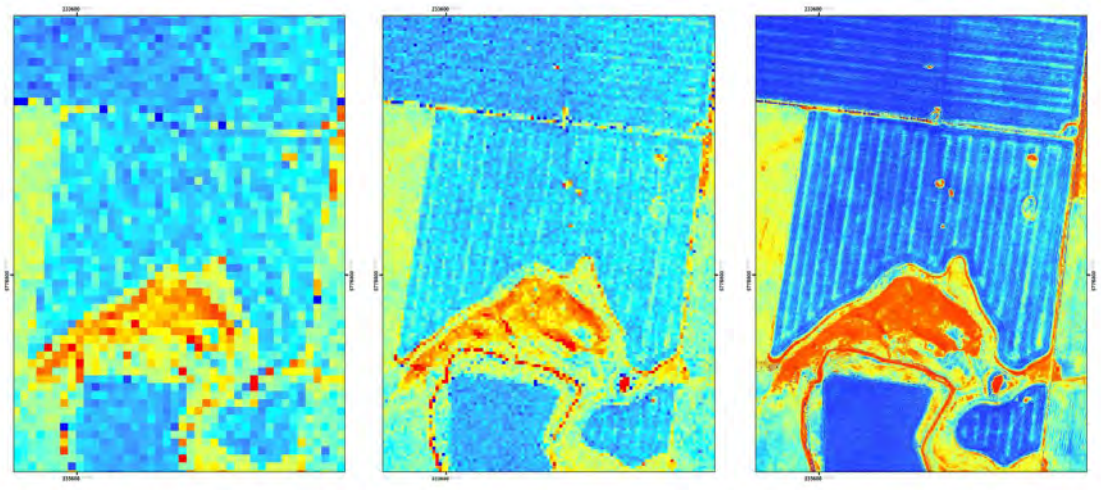


Figure 4

HIGH RESOLUTION SATELLITE IMAGERY

The **best new tool** that we have identified is **high-resolution satellite** (or aerial) **imagery**. A pixel size (the smallest 'piece' of the imagery on the ground) of 1m to 2m is needed to see detail. ***CTF Solutions*** has captured over 500,000ha of high-resolution satellite imagery over grain, cotton, sugar and horticultural farms across Australia. The imagery shows every bit of detail of the crop, and farmer responses have proved its value. The imagery is also spatially accurate, meaning you can go to any point in the image using a cheap GPS unit. This makes ground-truthing of the data simple.

The images below (Figure 5) represent different pixel sizes. You can clearly see responses when high-resolution (1m pixel) is used, and the detail identifies causes. The striping is a result of missed fertiliser.



25m pixel 10m pixel 1m pixel

Figure 5

The image below (Figure 6) shows an area of pest outbreak in a crop of canola. After ground-truthing, an analysis has been conducted to separate the paddock into affected (lighter colour) and non affected areas (darker colour).

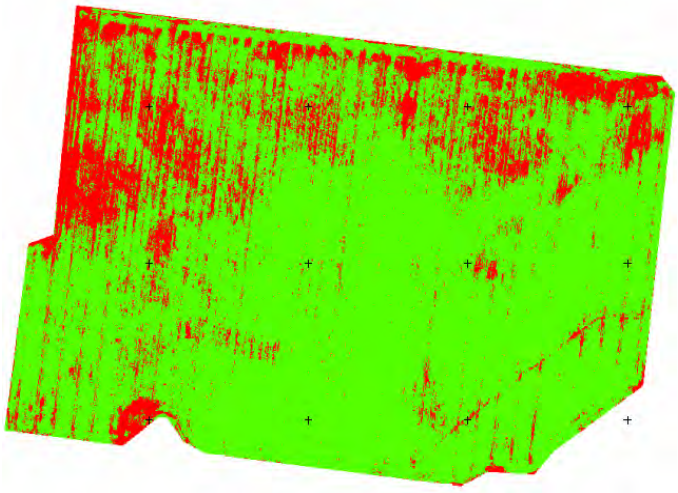


Figure 6

The image below (Figure 7) shows an analysed image and ground truthing information. The areas of good growth (higher NDVI) have higher tiller density and hand harvested yield, than the areas of poor growth (lower NDVI)

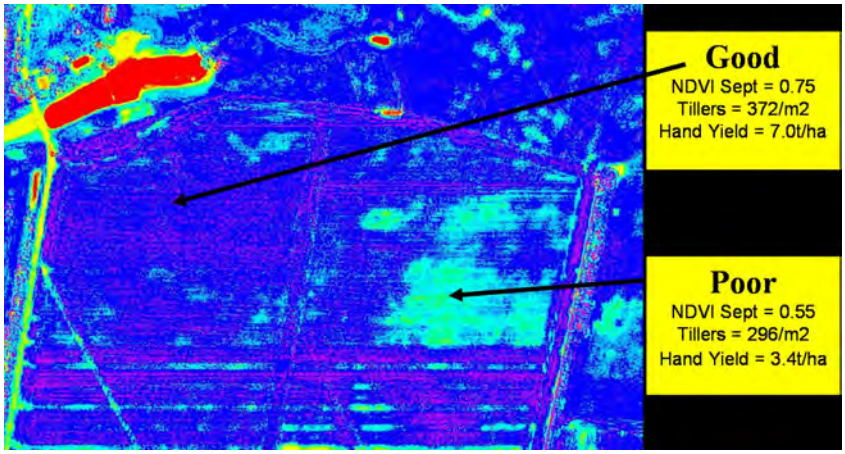


Figure 7

CONCLUSION

New technology such as RTK GPS has taken agriculture a long way in a short time. RTK can obtain detailed topography maps at a small cost. This can dramatically improve your CTF layouts and help manage water logging, drainage and erosion. There are additional pieces of new technology to further refine and fine tune production in CTF systems. The variability at a micro scale (i.e. less than a planter width) has been largely managed by CTF due to the removal of compaction. The next priority is to manage variability across paddocks and farms with the help of imagery and yield mapping. These tools have been shown effective to do this.