

Precision Agriculture for CTF farms

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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 100 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) provided minimal gains at best.

As well RTK guidance systems are now evolving, where in the near future, fully automated farm recording will be a reality.

TOPOGRAPHY MAPPING

Topography mapping is basically the collection of height/elevation data using RTK GPS (i.e. the same system that is used for guiding tractors). The intense field data collection is made easier by using a 4WD vehicle. Once collected, *CTF Solutions* analyses the data using a Geographic Information System (GIS), producing 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 overlaid 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 per annum.

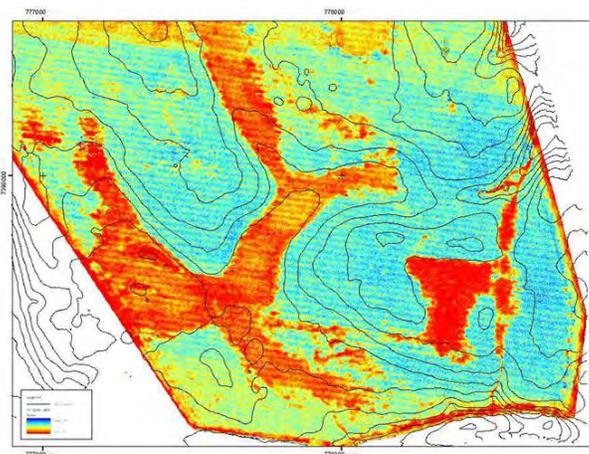


Figure 1

CTF Solutions offers a topography mapping service using our in-house RTK GPS for a cost of between \$6-10/ha (depending on conditions). If you have your own RTK GPS (such as Trimble, GPS-

Ag, Ag-Guide, or Beeline) then we can produce topography maps for \$2.50/ha using your own data collected when completing a field operation. CTF Solutions can provide advice on farm planning to add value to the service.

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. With CTF and 2cm guidance, 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 if they are not removed.



Figure 2

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

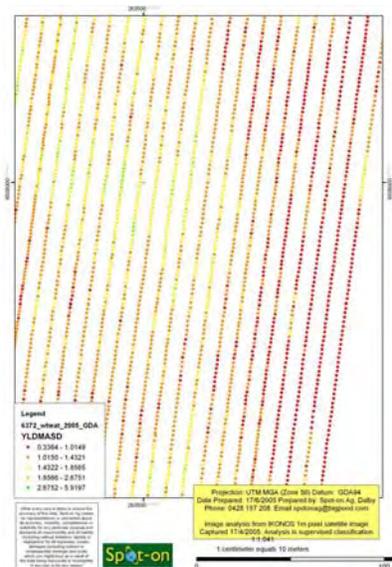


Figure 3

CTF Solutions has developed techniques to overlay yield maps from a number of years to produce ‘**yield stability**’ and ‘**averaged yield**’ 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 average yield 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).

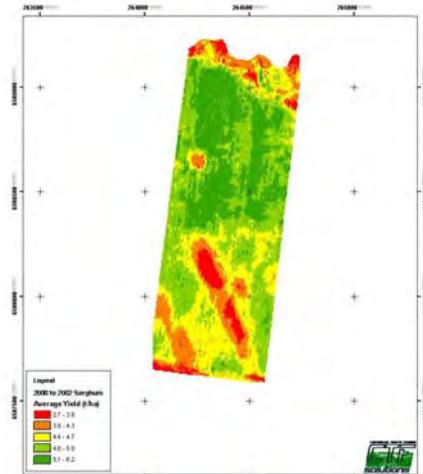


Figure 4

HIGH RESOLUTION SATELLITE IMAGERY

The **most exciting 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 750,000ha 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 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.

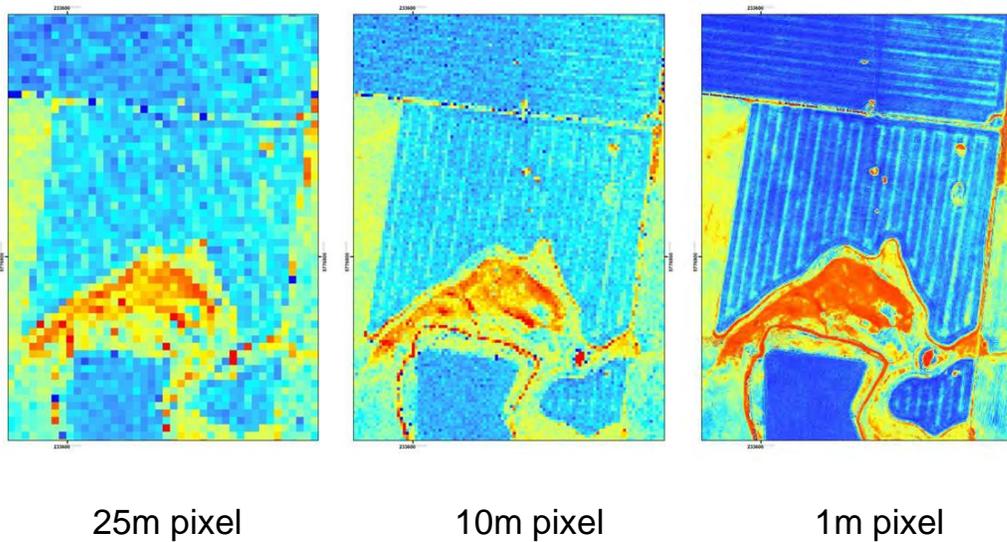


Figure 5

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). It was calculated the 20% of the paddock was affected by this particular pest, justifying control costs. With some pests, control can be very expensive, so the only affected areas can be targeted. More precise checking of the outcome is possible as well as monitoring in subsequent years.

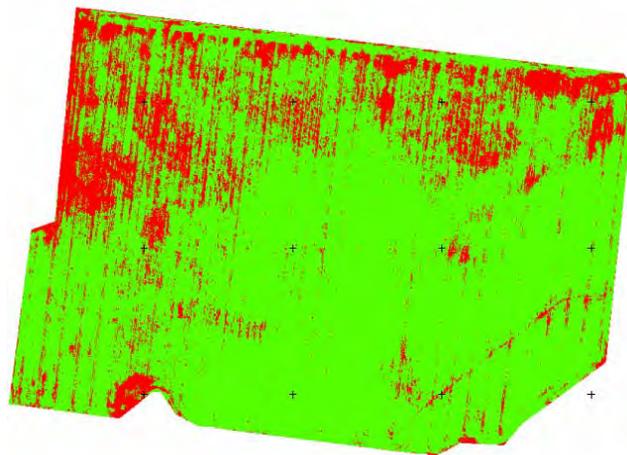


Figure 6

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) .

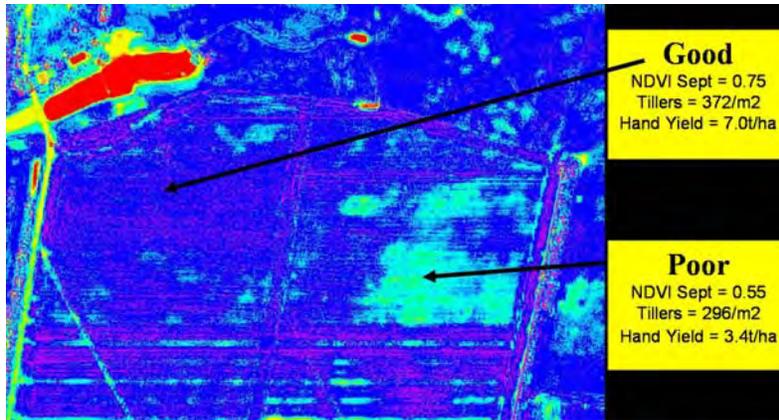


Figure 7

AUTOMATED PADDOCK RECORDING

Using a GPS can give us ‘real-world’ coordinates for everything we do on farm. Yield monitors were probably the first example of this principle. With yield data we know everything about the harvesting operation, exactly where it was performed. The same can now happen for all operations. Many guidance companies are now combining controllers with their systems to allow full recording of what was done, and exactly where it was done. Even details about machine performance (such as engine temperature, oil pressure, etc) can also be monitored and recorded for fault diagnosis.

Software programs will soon catch up to enable paper-free paddock recording automatically. This removes the need to spend hours each evening typing in the day’s operations into a typical farm mapping and recording program.

Companies such as Rinex, AgLeader, John Deere, Farmworks, Dygron and AGCO have already developed the framework of this principle. Fine tuning in the future will enable this to become a reality. Many of these companies are also developing farm networks, so that the data can be streamed automatically back to the farm office computer for storage and processing without the need for data-sticks or flash cards.

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.