IS CONTROLLED TRAFFIC FARMING ALTERING CROP PERFORMANCE ACROSS SEEDER WIDTHS IN CWFS DISTRICTS?

KEY MESSAGES

- Although not statistically validated a trend of either higher or lower NDVI's in the centre of the tram tracks was observed on 7 of the 14 farms investigated.
- The trend to wider header fronts makes the practicalities of redistributing residue evenly back across the width of the header all the more difficult and may accelerate any rate of change in crop performance.
- In the short term CTF producers should target even redistribution of crop residue across header widths
- Further work is needed and the author would welcome collaboration from others in helping to design a future experiment and statistical analysis.

Background

Variation in crop yield across previous years header runs is commonly seen in drought years with the magnitude and consistency of the effect largely dependant on Spring conditions and often related to soil moisture conditions at sowing. Colin McMaster, NSW DPI, quantified this effect as part of his work with the CWFS Water Use Efficiency project in 2010. His work is best summarised by his photograph, picture 1 and graph below.

As a component of the CWFS projects, Maintaining profitable farming systems with retained stubble in Central West, NSW and Application of CTF in the low rainfall zone, initial investigations were undertaken to identify any possible impacts on crop growth in controlled traffic systems where the header residue maybe inconsistently spread back across the tram track width over a number of seasons. The hypothesis was that over time in controlled traffic farming systems the repeated uneven spreading of header residue back over the tram track width would result in changed soil conditions that would ultimately lead to different "management zones" along the tram track.

Agronomic Issues

Producers using controlled traffic farming (CTF) systems report improved soil structure which helps crops convert rainfall to grain. Growers also report improved timeliness of operations and better efficiencies from farm machinery in terms of improved fuel usage and reduced hours per hectare.

Apart from the initial capital cost of converting to CTF system generally growers have reported few problems. All farm practices eventually have both negative and positive impacts on system performance. For example herbicides worked really well until widespread herbicide resistance resulted in many cheaper chemical options not working.

Within the low rainfall cropping zone the CWFS districts probably have the longest history of farmer adopting CTF systems, so effort was made to investigate any potential longterm negative impacts of CTF farming. This resulted in a preliminary investigation into whether any differences in crop growth could be observed across the tram track width that may ultimately lead to different "management zones" along the tram track.

Trial Design

Fourteen producers across the CWFS region self-nominated to be involved in the project from an email sent to CWFS members in June 2015. Within this producer group the date of adoption of a controlled traffic system ranged from 2006 to 2014.

FIGURE 1 McMaster 2010

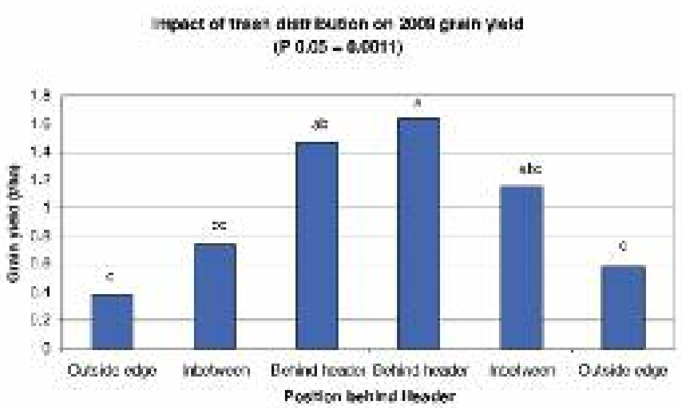

FIGURE 2 2010, Colin McMaster, NSW DPI as part of the CWFS Water Use Efficiency project

It was assumed that changes in NDVI across the seeder width represented changes in crop performance resulting from different nutrient or moisture conditions. If a difference in NDVI across the seeder width could be observed in an otherwise visually 'even' crop then it may suggest some difference in crop performance. These differences in NDVI maybe as a result of seeder setup and operation during the current crops establishment or some other longer term impact of CTF such as inconsistent spreading of header residue back across the tram track width over a number of seasons.

During the 2015 growing season 3 representative a joining seeder widths were selected. 5 NDVI data sets using a Trimble green seeker were recorded across each seeder width, each data set was roughly 10 m apart. This resulted in 15 data sets for each sampled paddock.

The data sets were then individually corrected to ensure they represented the same direction and speed of travel across the sowing width. Finally all data sets were combined to provide a representative picture of changes in NDVI across the planter width.

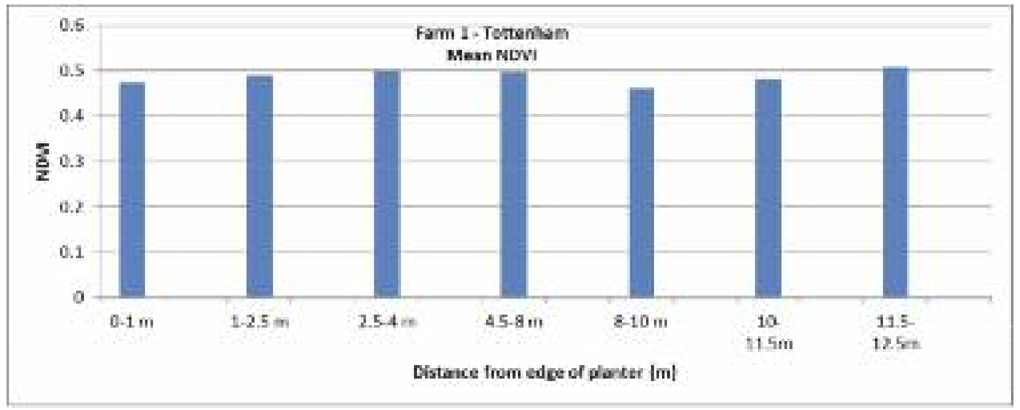

FIGURE 3 - FARM 1 CTF practiced for 6 years, 2015 crop chick peas just flowering

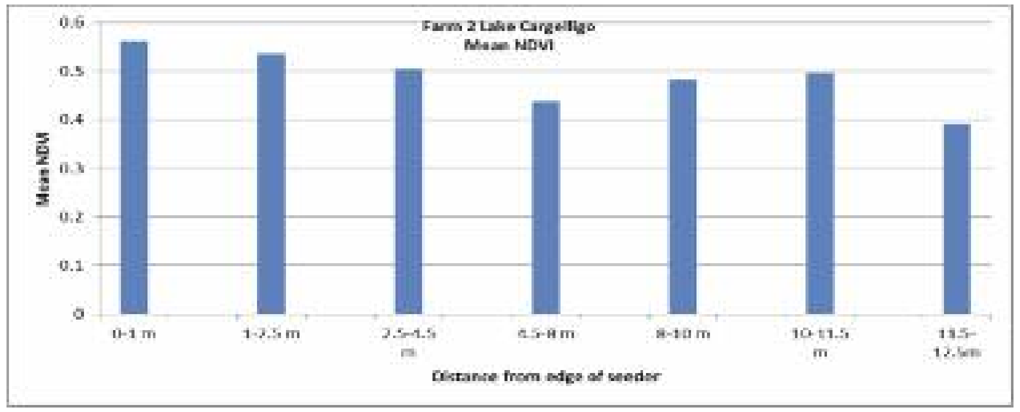

FIGURE 4 - FARM 2 CTF practiced for 4 years, 2015 field peas just flowering but had not completely

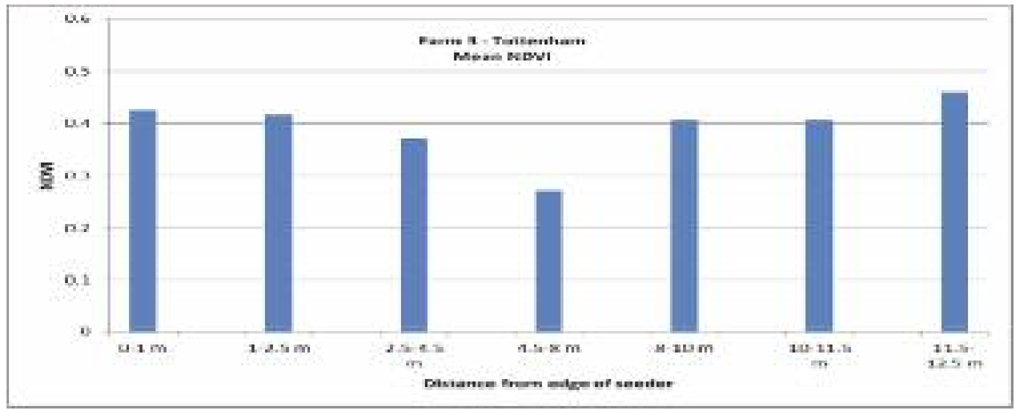

FIGURE 5 - FARM 3 CTF practiced for 3 years, 2015 crop chick peas just flowering

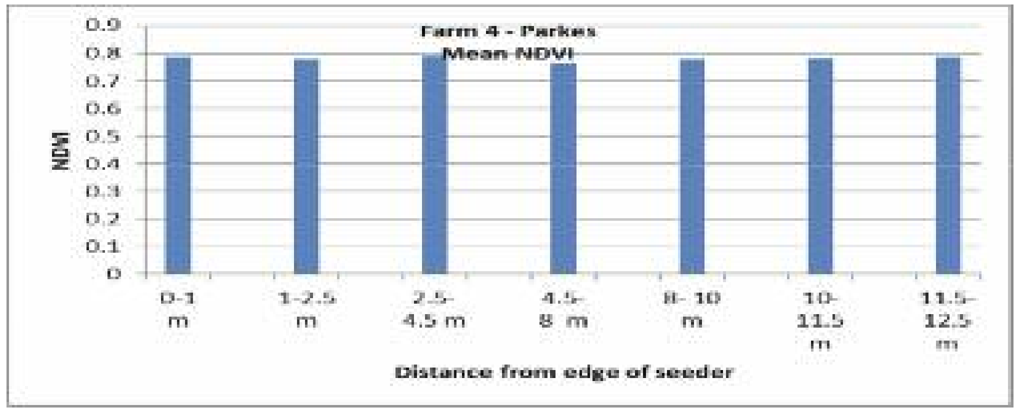

FIGURE 6 - FARM 4 CTF practiced for 8 years, 2015 wheat GS 31

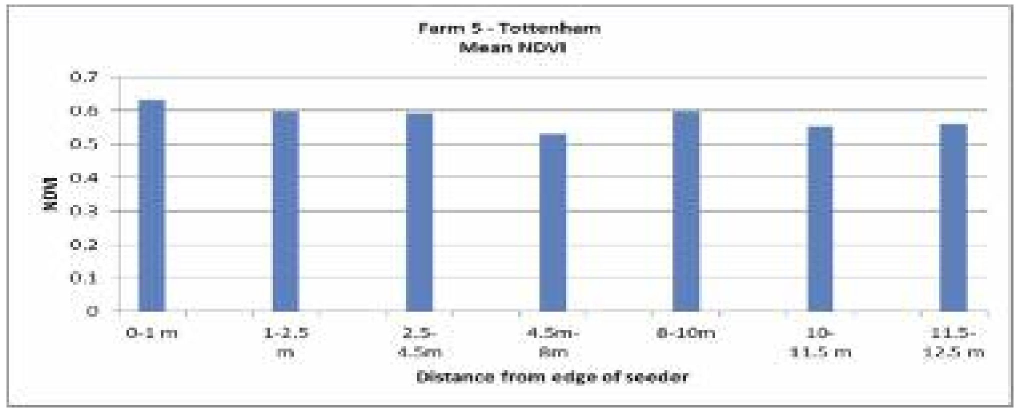

FIGURE 7 - FARM 5 CTF practiced for 7 years, 2015 crop wheat GS31

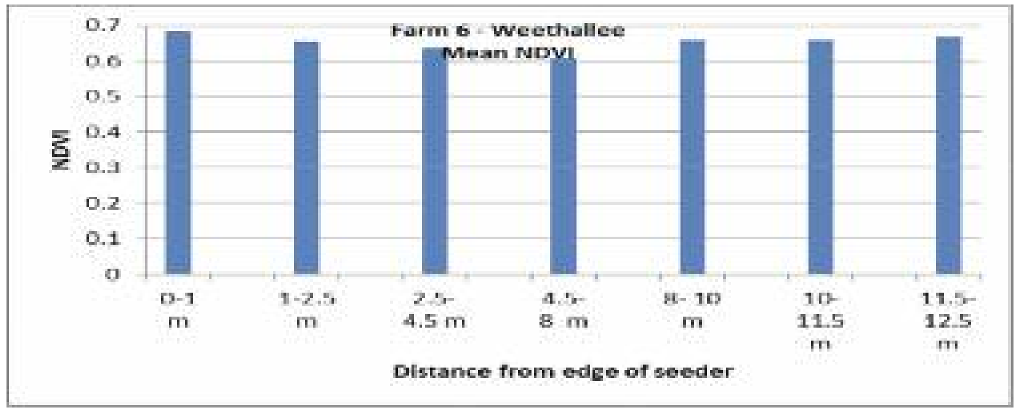

FIGURE 8 - FARM 6 CTF practiced for 3 years, 2015 crop barley GS30

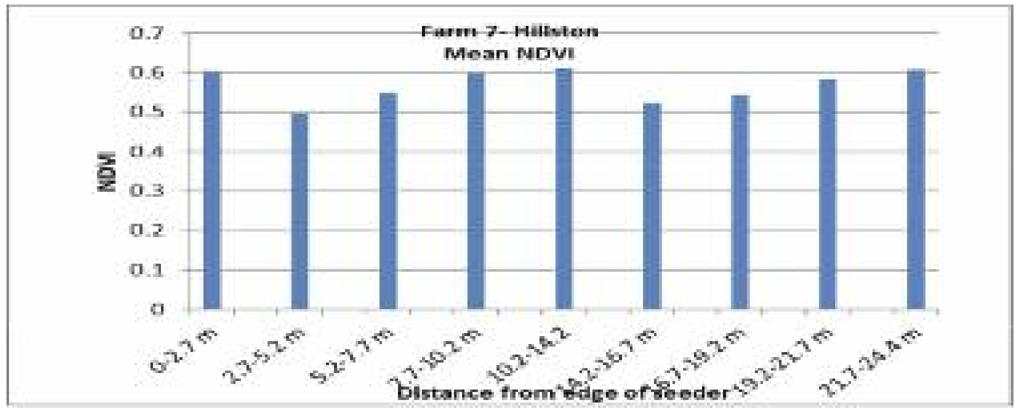

FIGURE 9 - FARM 7 CTF practiced for 2 years, 2015 crop wheat GS 33

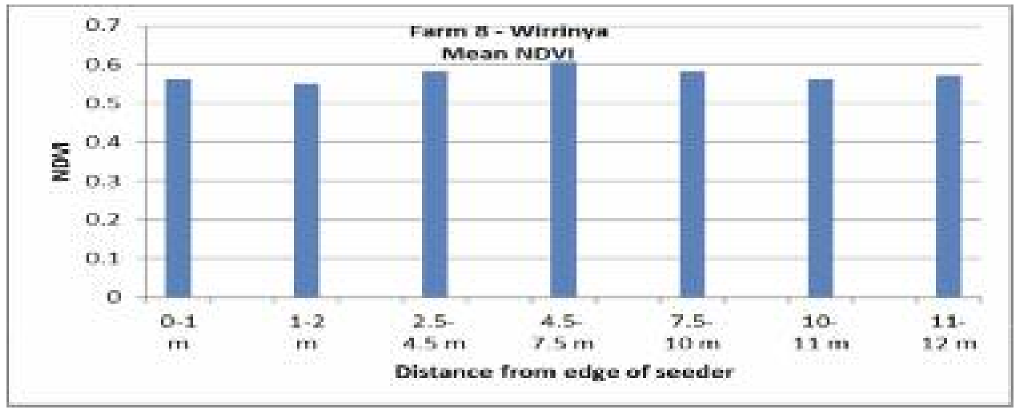

FIGURE 10 - FARM 8 CTF practiced for 8 years, 2015 wheat GS 30

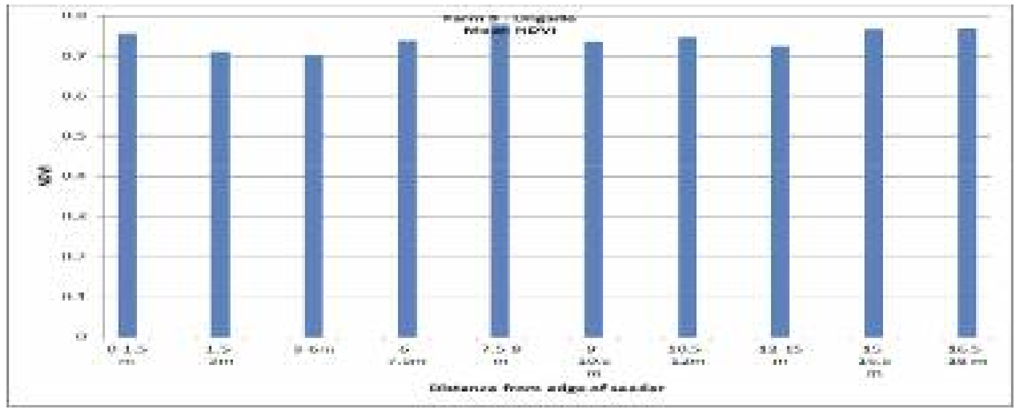

FIGURE 11 - FARM 9 CTF practiced for 9 years, 2015 crop wheat GS40

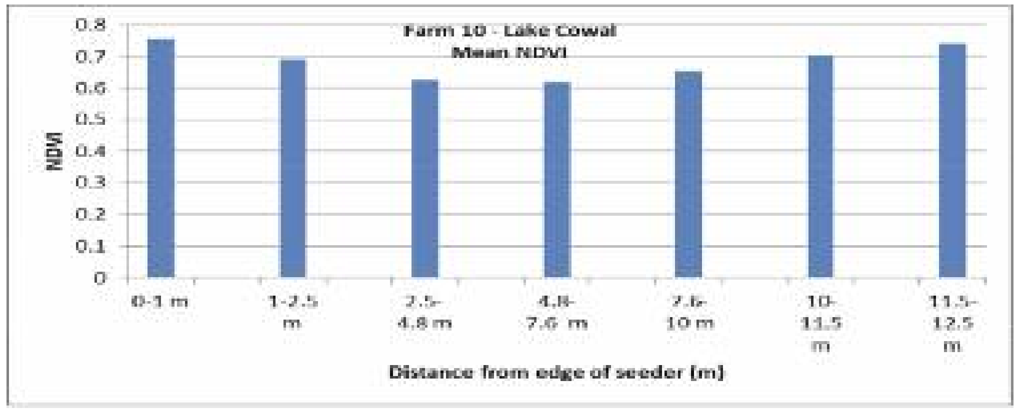

FIGURE 12 - FARM 10 CTF practiced for 4 years, 2015 crop barley GS33

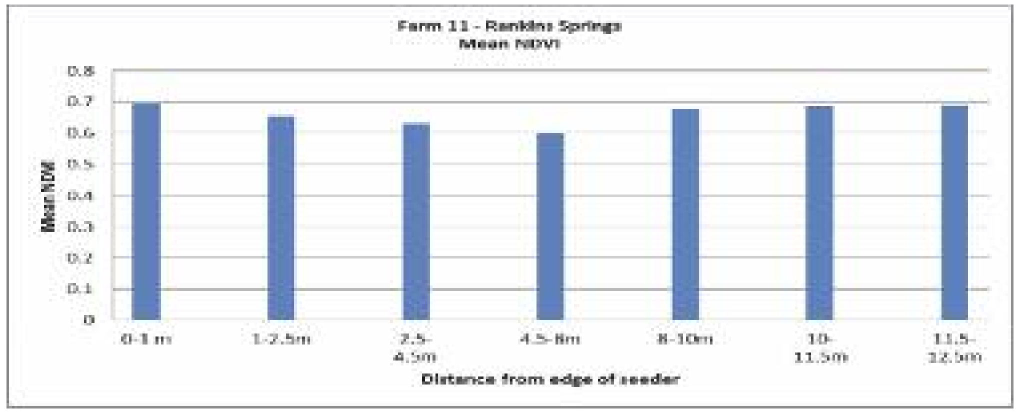

FIGURE 13 - FARM 11 CTF practiced for 7 years, 2015 crop barley GS 31

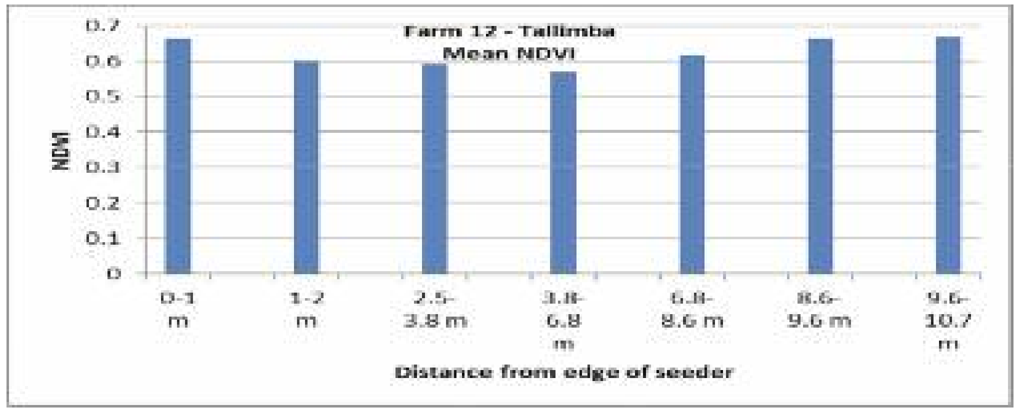

FIGURE 14 - FARM 12 CTF practiced for 5 years, 2015 crop barley GS41

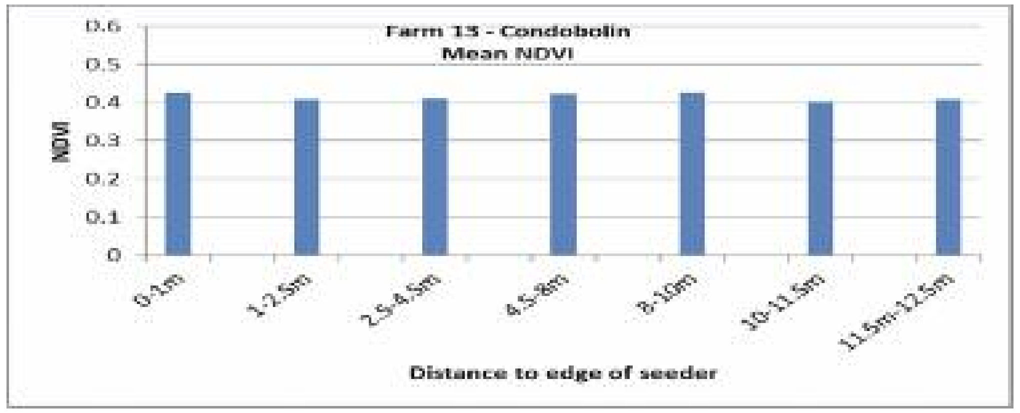

FIGURE 15 - FARM 13 CTF practiced for 13 years, 2015 crop barley GS55

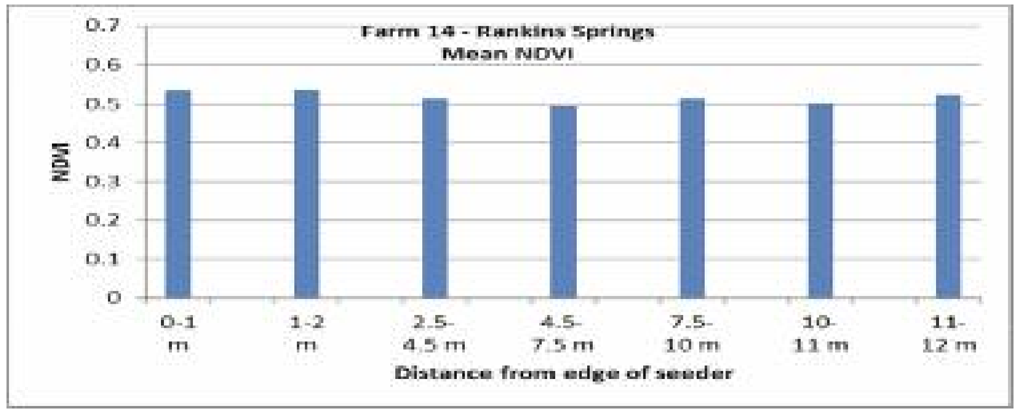

FIGURE 16 - FARM 14 CTF practiced for 10 years, 2015 crop wheat, paddock windrow burnt 2014 and 2013.

Results

As shown in graphs.

Discussion

If CTF systems resulted in changes in crop growth due to poor spreading of crop residue back over the full width of the header then the expectation was to observe a trend in a graph plotting crop NDVI against distance from edge of seeder width similar to C. McMaster's (2010) yield vs distance from edge of header graph (figure 1).

Seven farms, 1,4,5,6,9,13 and 14 show no trend at all. This suggests that the CTF farming system is not altering crop performance across the seeder width and that the farmers are achieving accurate seed and fertilizer distribution across the width at sowing. Possibly farm 5 results show some uneven seeder performance may be seen but this could not be confirmed.

Farms 7and 8 may show a trend similar to McMaster. Notes from farm 7 suggest that some overlap of sowing widths may have happened which would explain the higher readings at the edge.

Five farms, 2,3,10,11,and 12 exhibit poorer crop performance in the centre of the planter width. This result maybe due to the effect of wheel tracks or heavier crop residues relative to the rest of the paddock lowering crop performance. Again the exact cause could not be identified from the data collected.

Whilst the author acknowledges this work is not statistically validated a trend of either higher or lower NDVI's in the centre of the tram tracks was observed on 7 of the 14 farms investigated. It is suggested by both the author and cooperating farmers that the idea that uneven redistribution of crop residue across header widths in CTF may result in future changes to crop performance across tram tracks. Further investigation is warranted as the trend to wider header fronts makes the practicalities of redistributing residue evenly back across the width of the header all the more difficult and may accelerate the rate of change in crop performance.

Acknowledgments:

The author acknowledges the support of cooperating farmers in allowing access to both their crops and paddock records. It is hoped that in the future with further work a more definitive result can be found.

John Small
Central West Farming Systems

GRDC project CWF00018 - Maintaining profitable farming systems with retained stubble in Central West, NSW

GRDC project ACT00004 - Application of CTF in the low rainfall zone.

WHICH MAPPING TYPE WILL SUIT MY FARM?

CREATE AERIAL MAPS

General interest or just getting started with precision agriculture

Collect yield data from header and create maps.
Add background aerial for improved overview.

ADD AERIAL IMAGERY

Initial Problem Identification

In areas where there is **unexpected low yield**, having a few year's worth of data helps to define if the problem is consistent or season dependent.

To improve your understanding of soil characteristics, the first step is to undertake soil testing. Identified soil constraints can then be further investigated:

EM38 If you have a wide range of soil types try EM38 and deep soil testing. (This won't work for those with high levels of rock.)

GR Include gamma radiometrics for an even better picture. It can often be done at the same time as EM38.

pH If low pH is a common problem in your area, determining pH levels is also important.

Maps can then be used to identify potential causes and prescribe zone-based management plans. Zone paddocks based on soil type and try different management approaches and inputs where yields are inconsistent.

Refine and Improve your Approach

Layering maps can be used to create an enhanced view of the paddock.

FIRST STEPS

- NDVI imagery during growing season to assess crop growth.
- Mapping protein at harvest.
- Nitrogen sensing, especially when it is combined with variable rate application.

POST SEASON ASSESSMENT

- Look at application rates compared with yields to identify where your process could be improved.
- Analyse returns for PA application compared to existing application rates.
- Assess different map layers to see how well they assisted in improving your soil zoning.

CONSIDER

- Expanding base data such as soil testing, EM38 mapping or pH testing to other paddocks.
- Investing in equipment such as variable rate spreading and spraying equipment to allow more flexibility in application of chemicals and fertiliser.