

Variable Rate Application and Controlled Traffic at Cunderdin, Western Australia

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INTRODUCTION

Our family business is located between Cunderdin and Meckering, Western Australia. We produce grain under a dry land, no-till, controlled traffic system. Our average annual growing season (April to October) rainfall is 295 mm (274mm last 10 years, and 168mm in 2006).

In 2007 we have sown all our property to crop, with the exception of one pasture paddock. We don't plan to have any established pasture in our rotation. Parts of our farm have been continuously cropped for over 20 years. This year we planted 5500+ hectares to wheat, barley, canola, lupins and oats intended for export hay. We also include field peas in our rotation. Our rotational plan is 60% cereals, 20% legume and 20% canola, but subject to change with prices and seasonal conditions.

CHALLENGES

The biggest challenges for the production side of our farming system are nutrient management, in-crop disease control and herbicide resistance. Like all primary producers the real challenge is to profitably produce commodities long term under a sustainable production system.

OUR CONTROLLED TRAFFIC SYSTEM

Our complete CTF system is now in its third year of operation. We operate on a 9.144m (30ft) system with centre to centre wheel spacing at 3 metres.

The main equipment in our system is made up of two seeding rigs 9.144m (30ft) & 18.288m (60ft), one boom sprayer 36.576m (120ft) and one harvester 9.144m (30ft).

Other equipment includes a liquid cart, multi-spreader and chaser bin all with 3m wheel widths and a hooded/shielded sprayer with a working width of 9.144m.

Two tractors, the SP sprayer and harvester are all equipped with factory fitted auto-steer hardware. A shared screen and software is moved annually between the sprayer and harvester. The GPS receivers are interchangeable between machines and typically the tractors and header operates on an RTK signal (+/-2cm), while the sprayer operates on the RTG signal (+/-10cm).

We have three surveyed fixed base station sites where our base station is positioned as required.

Both seeding rigs and a multi-spreader are able to apply inputs at variable rate, using Zynx controllers. Tractor operation is kept simple with the use of a factory fitted guidance screen to control all auto steer functions and a separate Zynx screen to control all seeding, spreading or shielded spraying functions.

HOW WE STARTED WITH PRECISION AGRICULTURE

With the increased level of herbicide resistance, particularly to grass selective herbicides, Greg Fulwood had a shielded sprayer built and also an aftermarket RTK auto-steer system fitted in 2003. The idea was to grow wide-row lupins and spray the resistance ryegrass with non-selective herbicides using a hooded sprayer, once the lupin crop was well established. This was successful however the aftermarket auto-steer system did not steer the machine accurately enough at seeding or when shielded spraying and crops suffered significant crop damage.

In 2005 we used factory fitted auto-steer and were successful in accurately sowing and shielded spraying, with minimal crop damage.

As soon as we saw auto steer in operation we realised the potential of such technology and during 2004 we planned out and purchased the equipment required to have a complete system including variable rate application in place for the 2005 season.

PADDOCK LAYOUT

We have not taken any technical approach to setting up run lines. Most paddocks are set up using the longest straight fence to determine the heading of the main run line. For each paddock the “Point A and Heading” method is used to set up the run line, using whole numbers for the headings. This allows the run line to be accurately entered and used by controllers in other machinery. When choosing an auto-steer system I believe that this method of setting up run lines is an essential feature. An added beneficial feature is being able to name the run lines, rather than just numbering each run line. This allows headlands and other minor run lines to be selected easily and accurately by the operator.

One recommendation is to have a common run line for the whole property where possible to keep the system simple for all operators.

It is important to ensure headlands provide access for filling equipment at seeding and for harvest paddock storage equipment.

Our longest run is around 2.5km and shortest less than a few hundred metres. The ideal run line length is difficult to nominate as it depends on machinery capacity and actual crop yields. The limiting factor is usually the header grain tank capacity and efficient distance for the chaser bin to travel between header and paddock storage.

VARIABLE RATE APPLICATION

In 2005, 2006 and 2007 we applied compound fertiliser and nitrogen on all cereal crops and canola crops using variable rate prescriptions. Prescription zones are created biomass using analysis carried out by Silverfox, and also take into consideration results from soil testing of these zones plus overlaying of previous years yield maps as well as input from our knowledge of paddock performance. Rates are decided for each zone paddock by paddock and are often altered just prior to seeding depending on moisture conditions and crop condition in the case of top up nitrogen.

We apply compound fertilizer and urea at seeding and spread urea post seeding using a multi-spreader. Test strips for each prescribed rate of fertilizer input are run in the direction of traffic across each variable rate zone. This allows accurate analysis and assessment of the economic benefit of varying the rate using yield data collected at harvest.

BENEFITS

Benefits of operating such as system are numerous. Some of the main benefits are:

- Zero overlap resulting in an instant saving on fuel, seed, fertilizer and chemical (7 to 8% saving)
- Inter-row sowing allows tynes to be used for sowing in a stubble retained system
- Potential fuel savings with machinery operating with less wheel slip.
- Long term improvement is soil structure in zero traffic areas.
- Reduction in operator fatigue and ease of operation.
- Increased header capacity (100% full header front).
- Inter row spraying options.

ECONOMIC BENEFITS

Analysis by Dr Michael Robertson of CSIRO shows variable rate application of fertilizer increased gross margin of between \$4 and \$23 per hectare (average \$13/ha) in the 2005 season. In the same year approximately \$13/ha was saved on reduced inputs from zero overlap.

Michael's final analysis showed an annual gross margin increase of around \$130,000 for our cropping enterprise.

ALTERNATIVES

An alternative system is to have all machinery operating at 12 metres (40 foot) widths. This system has some advantages over the 9 metre system, including increased harvest capacity and the convenience and simplicity of having seeding and harvesting equipment operating on the same tramlines. This system is something we are still considering, although we wanted to have the seeding capacity of 18m seeding equipment at the time of implementation.

FUTURE IMPROVEMENTS

Areas of improvement in the future may include:

- Higher accuracy shielded spraying
- Larger harvest capacity (60 foot front?)
- Change to a 40 or 45 foot system for increased harvest capacity
- Complete removal or destruction of weed seeds at harvest
- Faster/simpler seeder filling
- GM technology to assist with herbicide resistance weed control
- High accuracy seed and fertilizer placement at sowing & disc seeding equipment
- Rear discharge of grain from harvester to chaser bin
- Remote sensing of plant nutrition requirement
- Remote sensing of plant disease and weed burden

- Remote sensing of soil nutrition & variable rate application of lime etc
- Precise variable rate application of separate N P K and trace elements
- Real time communication of machine activities and yield results to each other and to management.

CONCLUSION

- Large productivity/ profitability gains can be made with a relatively small initial capital outlay
- CTF systems can be continuously improved or added
- Plan out your “dream” system and then start by implementing it in order of what will give you the best return on capital
- Don’t ever buy a new tractor without ticking the box for factory fitted auto-steer!