Precision Agriculture – A Point in Time

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INTRODUCTION

This is a family farming business located at Yeelanna on Lower Eyre Peninsula, South Australia. The business comprises my parents, Max and Julie, myself, and my wife Julie, and youngest brother Jordan and wife Kylie. I am the eldest of three boys, with Jordy being the youngest. Our other brother Leighton works for Landmark as a Research Agronomist at Paskeville on Yorke Peninsula.

In 2008 we are cropping 3000ha with no livestock. In conjunction with the CBA we own just over 1600ha, lease remaining 1400ha of that. Crops we grow are Wheat, Malt Barley, Feed Barley, Canola, Faba Beans and Lupins. Rotation is highly variable and often based on weed control.

- Our Annual Rainfall is 433mm which in the last two years has only averaged 355mm
- Growing Season Rainfall 346mm which in the last two years has only averaged 195mm
- Because of this our 10 year rolling average for wheat yields has rolled down to 2.95T/Ha.
- Our biggest issues are herbicide resistant ryegrass and snails / slugs.

Similar to much of southern Australia we have highly variable soil types. We range from sandy buckshot gravel pH 5.5 to highly alkaline clay soils of pH 8.5, often within 50 metres or so. The property we lease is predominantly sand over clay with limestone reefs running through. Max has always had a real interest in soil and has been measuring and testing soil since the early 1980s. Because of this we have been "site specific" farming for years, especially during the pulse phase of the rotation, growing beans or lupins in odd shaped pieces in paddocks following soil types.

PRECISION AGRICULTURE

In the late 1990s we moved into the Case IH family of Harvesters and our local dealer set up our harvester to Yield Map as part of a trial site we were involved with. This gave us the ability to make lovely coloured maps of stuff we didn't understand or couldn't use with our computer but was fun to look at. The first paddock we successfully mapped was 170A, a sandy gravel (prone to waterlogging) flat rising to a clay loam (over limestone marl) hill. Max had been soil testing this paddock since the 1984 and trying to work out why the higher producing, "better" clay soils had lower inherent phosphorous levels than the poorer gravel soils. During 2005 that it became blatantly obvious to me that if you consistently apply a blanket rate of DAP but extract more grain from some soil types *of course* the amount in the soil will change! Figure 1.

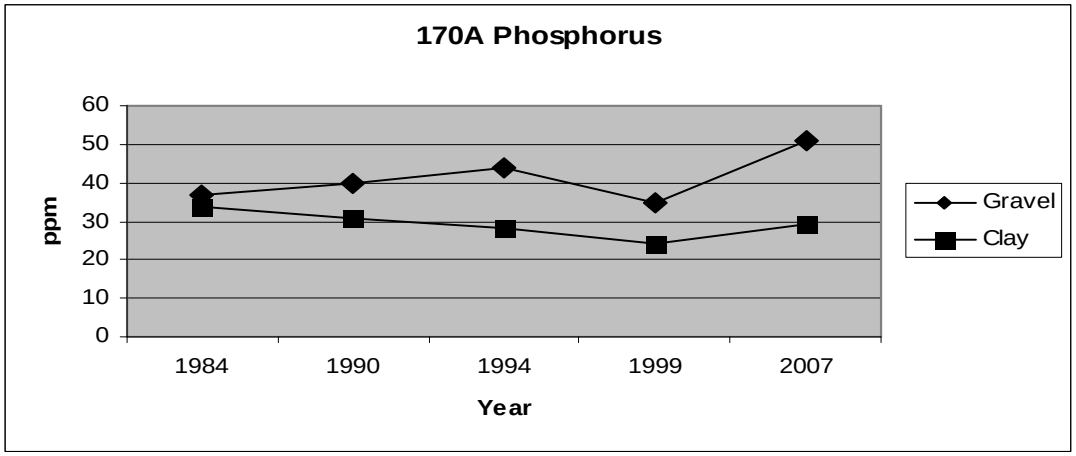

Figure 1. Historical Soil Phosphorous (Cowell P) across two distinct soil types.

We have been messing around with both small plot and paddock trials sites for years and marking out ideas with the standard chemical drum on a dropper positioning system. Trials were always weighed out with a weigh crate and we have manual records on everything in the office. When we changed over the airseeder we bought one that was “VRT equipped” even though we didn’t know why or how to use it!

We were determined not to jump on the GPS guidance bandwagon for the sake of straight line vanity and it wasn’t until the work done on at Maitland on Yorke Peninsula on interrow sowing that we could see some real benefits. We were already sowing up and back, and drive fairly straight, so the absolutely outrageous claims of “saving 10 to 15%” on overlap held no sway with me. No we are not overlapping 5 or 6 tynes on our 54foot airseeder, at least not before 2am anyway. So after debating with many people the pro’s and con’s of autosteer (and then discovering only one company could steer Cat Tractors) we made a move to a gpsAg A5 RTK.

We are now in our third year of 2cm auto steer and are very happy with our ability to interrow sow which is exceeding our expectations in our hills by successfully interrowing about 85 to 90% of the time.

We have been involved with SPAA and Allan Mayfield for some time and through this relationship have done some trial work with the *Yarra N Sensor*. In Figure 2 it can be seen mounted on the roof of the tractor. The N Sensor uses infrared light to measure “greenness” of the crop and we have in the past coupled it to our Bogballe spreader and spread urea variably. We have set it so where the crop is rich and lush green it applies less urea and where it is poorer and yellow it applies more urea. The same total volume of urea is spread in the paddock, just used more effectively.
For the last two years my brother Leet has made available to us Landmarks *NTech GreenSeeker* enabling us to compare the biomass maps from different machines in the same paddock.

Figure 2. Yarra N Sensor on roof coupled to Bogballe VRT spreader
and NTech GreenSeeker on front weights of tractor

I personally feel that either of these methods is going to be better for measuring biomass and variable rating urea than a satellite image. Mostly because you can get the image on the day you want it. The problem is that the cost of the technology is still a little difficult to justify.
So where are we at?

The next step was to take these two biomass maps and add them to five years of yield maps combine them. Actually this bit was quite beyond me so I emailed it to Sam Trengove, (Allan Mayfield Consulting) and he combined them into a zone map, of above average, average and below average

yielding zones across the paddock. With ever increasing prices of phosphorous it has become more important to maximise the efficiency of fertilizer. For our region, district practice has long been 100kg DAP, and 100kg Urea to grow a 3.5tonne/hectare crop of wheat on a cereal or canola stubble (64 units N, 20units P). Within our own paddock given the historical data of variable phosphorous readings across soil types (Figure 1) we decided to vary the phosphorous from zero to 20 units of P across both clay and gravel soils in a replicated trial to establish economic use of P for the paddock.

Late May we sowed a trial varying the rate of DAP, whilst balancing Urea to maintain a standard rate of nitrogen across the trial. Although the whole lot was mapped by the airseeder we still used the tried and true standard chemical-drum-on-a-dropper positioning system. Leaf nutrient analysis taken 10th June showed that phosphorous (P) levels were deficient in all areas of the paddock with the zero P treatment. During early August Leet and I mapped the paddock with the *GreenSeeker* whilst spraying to give a biomass map of the whole paddock including the trial. This did not show up any obvious treatment effects, probably as at this stage there was adequate soil nutrition for plant growth. Unfortunately for us August, September and October received no significant rainfall.

Next step was to successfully yield map the paddock again with the harvester. The unfortunate conclusion that we reached from this trial is that given rainfall there was adequate phosphorous nutrition for this crop to reach it's potential. Rainfall, not phosphorous was the limiting factor!
This trial has been repeated this year in the same location with variable rate DAP and has been sown to Faba Beans so we'll see if we can make Phosphorous, not rainfall the limiting factor.

Even though the 2007 trial did not show economic results, other soil tests taken across the property show that we have been accumulating phosphorous in our soil and we now believe we can better manage this resource. The next step is to purchase a more comprehensive controller for the airseeder and apply all seeding phosphorous as replacement plus 2 units from the previous year's yield map.

CONTROLLED TRAFFIC

This next bit I've put in to provoke a few questions and provide so controversy! I got very keen in 2005 after the wet spring to move strongly into CTF. I was sure after I mapped our wheel tracks across the paddocks that we were certainly doing some serious damage and restricting yield. We could see the ruts in paddocks caused by an annual average of 4 passes of the 6000L boomspray and MFWD tractor. We run a RTK autosteer so each pass is precisely down the same wheel tracks, so surely we have large amounts of compaction causing yield loss? I borrowed a penetrometer from PIRSA and set out to do some paddock transects. Jordy and I measured every row (305mm spacings), beginning at paddock edge and going out three boomspray passes, for ten separate paddocks; although I have shown only 137 rows here. (Figure 3). All measurements were taken at soil moisture field capacity and all these paddocks have had at least 4 passes in this year with a 6000L boomspray and this was all that showed up.

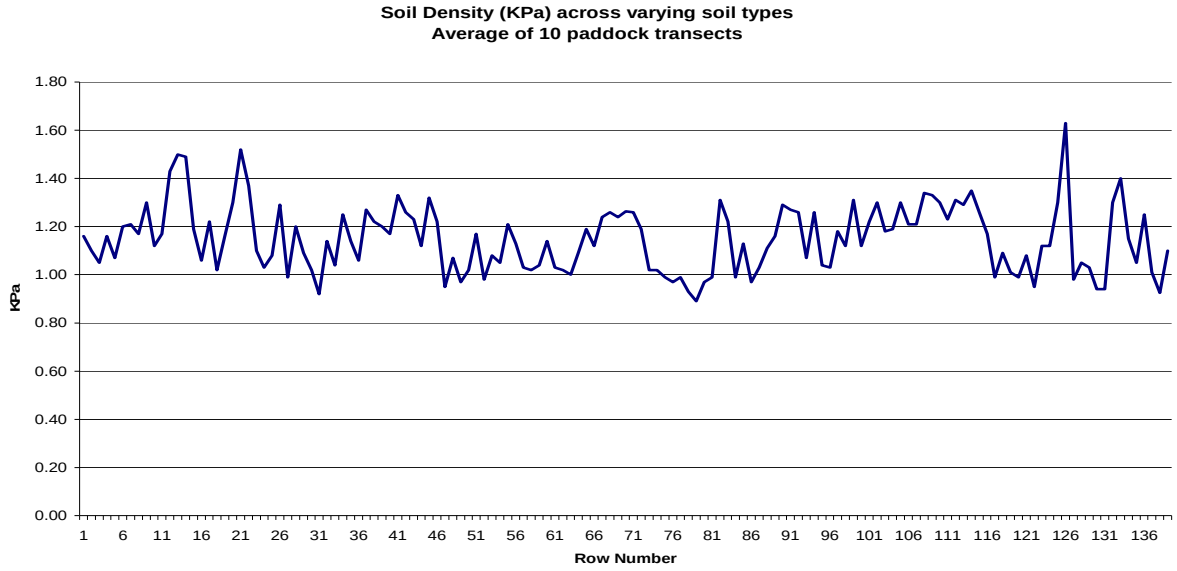

Figure 3. Soil compaction to 500mm depth measured at field capacity.

The two peaks at rows 13 and 21 and repeated at 125and 133 are the boomspray passes. Even though we could see the ruts, and the plants sown in them are smaller from being run over, we concluded in our soil type there is no significant compaction measured. We are part of another project run by Minnipa Agricultural Centre looking at compaction and early data seems to be suggesting in our soil types there are bigger yield restraints than compaction. We also leased a property in 2007 that due to the sheet limestone we used a 10m wide by 1.5m diameter round ribbed stone roller to roll 750 of 860 hectares immediately post seeding! When you are trying to smash rock into sand with a roller, compaction isn't in your thinking!

We also don't wish to downsize machinery to match wheel tracks up due to timeliness of seeding issues. It is probably cheaper to increase area and lease more land than spend money on changing machinery?

We also will always sow the trafficked rows as annual ryegrass control in unsown rows is more difficult to deal with.

Therefore, while we use a RTK autosteer and match machinery as close as possible without expensive modifications we are still unsure about some of the proclaimed benefits of purist CTF and the suitability to our system, but it is somewhere we aspire to get to over time.

CONCLUSIONS?

When we started down the yield mapping path there were certainly some neighbours who insisted on telling me that this stuff is irrelevant to farming, and we will never use it. At the time I responded that perhaps we wouldn't but maybe eventually my kids or grandkids could. And now within seven years and being pushed by high fertiliser prices we are really trying to get the best economic return for our fertiliser dollar.

We are working through a number of issues including; is it better to focus on utilising our better soils to their potential - thereby over time creating greater differences across the paddock or should we be focusing on trying to improve our poorer soils to even the paddock up over time?
We also have had to learn that when the technology throws a wobbly it is important that we don't also. We are only in each paddock once with harvester so you only get one chance annually to yield map it. If you are too impatient to work with the technology at harvest then you can't fix this in your January holidays. If the autosteer goes off line during seeding and you manually drive the remainder of the paddock you won't interrow sow this bit next year.

What is most important is to work out what suits your system and always remember you do what you want to do in this business. However, if I could leave you with a take home message, (apparently that is what you do at these meetings!) it would be get your yield mapper working and take lots of photos of everything.

I'd also particularly like to acknowledge the SPAA (Southern Precision Agriculture Association) as a tremendous resource and facilitator of Precision Agriculture. See: www.spaa.com.au