5.2 Demonstrating Different Controlled Traffic Options - Shelford,Vic

Location:
10km North of Shelford

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Rainfall (mm) Apr – Nov 07 :
411.2 mm GSR (from Sheoaks Bureau of Meteorology Weather Station).

Summary of Findings:

The PA Concept Farm gave growers the opportunity to see first hand the difficulties and successes of implementing new and innovative cropping techniques involving PA (Precision Agriculture) and CTF (Controlled Traffic Farming). Although final yields were not of importance due to the nature of the site, various observations throughout the year demonstrated to visitors some of the things to watch for when adopting these tools and practices. The fact that yields were not altered indicate the importance of maintaining dedicated wheel marks all season, and the implications of adding machinery such as that used to bale hay. The site also demonstrated that without amelioration, soil improvement due to reduced compaction can take a number of years to manifest into greater yields.

Weed burdens at the site highlighted the importance of ensuring control in wheel marks, whilst indicating that wider row-spacing does not necessarily mean increased weeds. The difficulties of keeping seeding equipment tracking straight when precision sowing were also encountered, making for a good discussion with site visitors about the various techniques that can be used to overcome this problem.

Costs of guidance were compared for the site, with $3/ha for line marking using a contractor with autosteer, $190/ha for a contractor to set up a whole paddock with beds and between $20,000 and $50,000 to get one machine setup with Real Time Kinematic (RTK) autosteer including your own base-station.

Background:
Precision farming techniques such as controlled traffic farming, minimum tillage, use of knife points, press wheels, wide row spacing, inter-row sowing and retention of standing stubble have the potential to deliver significant benefits to those who adopt them. The PA concept farm was developed to enable farm scale observations and analysis of these modern farming technology and agronomy.

The site was set up purely to demonstrate the practical implications of adopting these new technologies and practices, and was visited by many growers and advisors throughout the year.

Observations of the unreplicated plots were also made and noted, and this report will outline these and the interpretations of what occurred.

Trial Inputs :
Cropping inputs at the site followed the district standard for Gairdner barley. Eleven demonstration plots were sown in total, with treatments varying by guidance method, row-spacing, controlled or random traffic, inter or intra (on) row sowing and raised beds.

Trial Design:
The site was in a 20 hectare paddock, with the demonstration area divided into plots varying in size between a 0.5 and 2.0 hectares. Table 5.1 lists the treatments carried out at the site.

The demonstration plots ran for approximately 450 meters in a north-south orientation, and were ordered from plot one through nine from east to west (i.e. raised beds at eastern side of paddock) with the traditional practice carried out at the north end in plot ten. There was no attempt made to replicate the treatments as the site's sole aim was to demonstrate the various management techniques and PA tools.

Trial Results and Observations:
This site was designed to demonstrate the practical implications of implementing Controlled Traffic and Precision Agriculture practices and the following section will reflect upon the observations made at the site throughout the season. The treatments did not appear to greatly influence final yields, and given the circumstances they should not be expected to, due to the following reasons:

- The site is only in its 2nd year of CTF, and without some form of mechanical or chemical (eg gypsum) amelioration, no great yield differences would be expected to show up in such a short time.
- Weed control difficulties at the site meant the crop had to be cut and baled on much of the trial area. This was carried out with machinery that was not aligned to the two meter wheel centers used on the rest of the property, and instead was done in an around-and-round manner. When all operations of mowing and conditioning, wrapping and then removing bales from the paddock are considered, the trafficked area of the paddock, and the soil compaction resulting from it, was increased dramatically.
- Using Electromagnetic sensing mapping (EM38) at the site generated and produced by Martin and Jo Peters of Farmworks, we could see a great amount of variability within the soil across the paddock, confounding final results.
- The issue of weed control at the site would also have interfered with the yields, as weed infestations throughout the paddock caused varying pressures on the treatments. This further added to the confounding effect on the final results

Table 5.1: : Plants/m^2 counted in August; tillers, grass weeds and grass weed tillers/m^2 were counted in late October

Plot No	Plants/m^2	Tillers/m^2	Grass weeds/m^2	GW tillers/m^2	Treatment
10	106	352	45	219	8" Traditional Practice
9	105	365	14	132	16" Line mark for inter-row then visual for rest
8	79	403	31	117	8" Autosteer for all operations with sown wheel tracks
7	111	395	50	389	8" Autosteer for sowing then bare wheel/ visual for rest
5 & 6	104	369	30	225	16" Inter-row sowing using auto-steer for all
4	113	325	67	364	8" Line mark for sowing and visual for rest
3	125	335	35	189	8" Inter-row sowing using autosteer for all
2	132	364	63	369	8" Intra-row sowing using autosteer for all
1	140	414	62	368	8" Raised beds with autosteer

The presence of weeds at the site did address the common perception that weed numbers tend to be greater in wider sowing widths.

Weed numbers in the 8 inch row-space plots were not, as a rule, less than the 16 inch plots. Plot 9 (16") is shown to have 14 grass weeds/ m^2, whilst the next plot along, number 8 (8") has more than double the weed burden. These observations of course would have to be tested in a fully replicated trial to ensure more robust results were obtained, but they do seem to suggest that wider rows do not necessarily mean more weeds.

It also seemed that weed burden may have been decreased by having sown rather than unsown wheel tracks. Plot 8 (sown wheel tracks) showed a marked decrease in weed numbers compared to 7 (unsown) when counts were carried out late in the season, with 31 versus 50 weeds/ m^2 respectively. Although not replicated, this observation suggests that care must be taken to ensure adequate weed control in unsown wheel tracks, where competition by the crop is reduced. This may mean a dedicated shielded spraying operation in unsown wheel tracks prior to seed set. Another option discussed at the site was to direct chaff at harvest into the wheel tracks to form a thick mulch, which would also leave weed seeds in a known position where they could be addressed later.

▲ **Photo 5.4: Paint infiltration into compacted soil (one pass with mower-conditioner), indicating poor structure and no porosity.**

▲ **Photo 5.5: Paint infiltration into uncompacted soil, indicating good structure and porosity.**

One of the major aims of the site was to discuss the costs of implementing the forms of guidance tested, and the issues associated with each of these.

Contractor used to mark lines

This is the cheapest method of guidance used at the site, at around $3/ha, and is often utilised by growers wishing to try out some form of guidance without the up-front cost of satellite based systems. Our collaborator at the site, David Stephens, managed to drive in very straight lines when following a pre-set line throughout the year, but acknowledged that this would be much more difficult and tiring across large areas. When starting out in CTF and inter-row sowing, many people have done so using this method of guidance, and have then moved to a more expensive option once they are sure of the benefits of the system.

2cm Real Time Kinematic (RTK) autosteer

At the opposite end of the cost scale for guidance is RTK autosteer. The ease of use and the accuracy of guidance achieved by this tool make it a very attractive option for growers wishing to make the move to precision sowing and CTF, but many people see the cost as a prohibitory factor. Until recently the cost of changing one machine to RTK guidance was in the order of $50,000, but with new products selling at below $20,000, it is starting to become cheaper and easier for growers to access RTK equipment for their farms. The continued construction of the Victorian Government's GPSnet statewide base-station network (otherwise known as the Continuously Operating Reference Station (CORS) network) will mean that soon growers and contractors will have access to the same corrections in most cropping paddocks across the state, with much improved year to year accuracy for PA applications.

Raised Beds

Finally, raised beds were another treatment demonstrated at the site. Raised beds are not only a controlled traffic technique, but the fact that all wheels run in the furrows means that, once installed, they are a permanent form of guidance. Costing around $190/ha for a contractor to cultivate twice, form beds and set up headland drainage, beds will last a number of seasons and can be helpful in many situations where there is a waterlogging risk in wet winters. One point to come out of using a contractor to form beds at the site was the difficulties of using two different base stations for the bed forming task and all subsequent operations. Sowing at the site caused considerable trouble for David Stephens when trying to drive using his autosteer and base station, after the contractor had used his own for raised bed installation. This is not to say anything against contractors being used to form beds, as David Howard did a fantastic job of setting up this treatment at the site in both years. The point to note here is the difficulties caused by changing base stations between operations. Once again a fully operational CORS network would eliminate this problem, as both contractor and farmer could use the one system for their respective operations, reducing the discrepancies in accuracy between operations and ensuring precision is achieved.

The other treatments examined at the site were inter-row versus intra-row sowing. This proved to be quite difficult to achieve, with neither treatment being carried out with the accuracy desired.

Photo 5.6: Visitors to the site discuss Precision Agriculture (PA) and Controlled Traffic Farming (CTF) over lunch during a field day.

Following is a list of just a few of the factors to consider when setting up to achieve precision sowing (Courtesy of gps-Ag) For more information go to the PA and CTF page at www.sfs.org.au

Drawbar length

a. General rule of thumb drawbar length should be half the implement width.
b. Eg 60ft implement needs a 30ft pull
c. Longer drawbars give more leverage and better tracking.

Tyne Layout

a. Tyne layout is important in that we need to have an even tyne layout, the layout needs to be symmetrical around the centre of the machine.
b. For example the lead tyne on the right side should be the same position on the left. This gives equal loading left and right to balance the machine.
c. A centre tyne will also make setting other tyne widths easier as you will be measuring from one central point, rather than trying to measure from some other arbitrary point.

Terrain

a. Undulating terrain and side slopes make accurate tracking more difficult
b. Try to work up and down slopes not across slopes
c. If working across slopes try to work in the same direction each time.
d. Undulations and Gilgai formations often mean the implement does not maintain an even depth and hence the load on the implement is unbalanced and causes the implement to skew.
e. Parallelogram / independent individual tynes alleviate this problem.
f. Shorter drawbars are probably better if you are working on side slopes.
g. If you have this type of country then narrower implements are better.

Following last years tracks

a. In every situation the tyne/implement will try to follow the path of least resistance.
b. Cutting across and old path will often cause the implement to follow in last years path.
c. Make sure you have a wide headland so that you can clearly get straight tracking with the implement out of the ground before you lower the implement.
d. Heavy soils often have a greater differential between last years and between the row tracking hence they have a greater tendency to track in last years row, but in some instances, such as at the Concept Farm, it can be difficult to sow on previous rows due to the stubble.
e. In sandy soils the difference between pulling in last years row or between last years row is not great hence the implement should track better.

Seeder Box - Pull Behind v Pull Between

a. We think that pull behind will be marginally better for accurate tracking rather than pull between. Pull behind means the implement is nearer the tractor and so more closely follows the tractor.
b. Pull behind boxes can also load weight on the rear wheels of the implement aiding stability.
c. Pull behind boxes with front and rear axles can sometimes have a lateral pull of their own and may pull the implement off course, make sure if the box has a front caster wheels that they are free to rotate.

David also pointed out the importance of considering the multiples of your new machinery system. When buying new or adjusting old machinery for CTF, remember to consider the fit of that machinery into the system. A 3:1 seeding width to axel ratio (i.e. 3m wheel spacing with 9 meter seeder) for example will work best with a boomspray that has sections in multiples of three.