Precision Ag Trials

Wheat seed rate trial

Hill River via Clare, SA

Although PA tools have been available to Australian grain growers for many years, and the benefits have been well documented, it is estimated that less than 1-% of grain growers utilise PA 'beyond guidance' in any form.

The objective of this GRDC / SPAA funded project is to increase the level of adoption of PA 'beyond guidance' by broadacre farmers. The project specifically aims to increase the level of adoption of variable rate (VR) by growers in the project to 30% by 2013. This goal will be achieved by demonstrating how to use PA tools to growers at a regional level and by increasing the skills of growers and industry in PA to a level where they can then use PA tools in their farming systems to achieve economic, environmental and social benefits.

Trials and demonstrations are conducted on growers' properties and are visited throughout the season using farm walks and workshops to discuss the advantages and disadvantages of PA techniques with the involvement of other regional growers.

This information sheet presents the outcomes of the SPAA trial **assessing wheat sowing rates and the effect on ryegrass competition** in season 2010.

Aims:

- To compare the effects of seed rate on ryegrass competition.
- To assess the potential of zone management of fertiliser and other inputs.

Background:

Ryegrass is an economically important weed in the farming system that is difficult to manage due to its wide adaptability, ability to produce large amounts of seed and the increasing incidence of herbicide resistance in this weed. When present in large numbers ryegrass can cause significant yield losses through competition for water, nutrients and light.

Ryegrass density, as with all weeds, varies across paddocks. Ryegrass spreads only short distances (1-2m) via natural dispersal, and up to 20m when moved through a combine harvester. This means that ryegrass patches are relatively stable from one year to the next and could be managed site specifically provided an accurate map of ryegrass patches can be generated. Expensive ryegrass control measures could be targeted more specifically to problem patches for greater economic return. Due to its wide adaptability, ryegrass density will often be higher in zones where crop growth is retarded for some reason, whether it be due to salinity, sodicity, nutrition or some other constraint. In this trial the aim is to assess the benefit of increasing seed rates in ryegrass patches to increase competition for resources and reduce ryegrass seed set.

About the trial:

The trial paddock is 49ha and is located approximately 8km south east of Clare, in the Mid North of SA, where it receives an average annual rainfall of 500mm. The soils in the paddock are heavy clay soils.

The paddock was zoned into three zones using three historical yield maps using the composite map generator in the John Deere Apex software (Figure 1b). This map was used to target four samples within each zone for soil testing. A composite map was also generated using historical Landsat data (Figure 1d). This has a similar pattern to the yield composite map, where lower crop growth correlates with lower yields and higher crop growth correlates with higher grain yields. According to the growers these maps also correlate well with ryegrass patches, where ryegrass is at higher density in the low yield (red zone) and low crop vigour zone and lower density in the high yield (blue zone) and high crop vigour zone. The ryegrass distribution across the paddock may be a result of the variation in competition imposed across the paddock through variability in crop vigour. The lower yield, lower crop vigour and higher ryegrass density areas are also lower in elevation (Figure 1c), which may also contribute to the characteristics of this zone due to the flow of water to this zone and potential transient water logging.

Trial strips of 70, 90 and 120 kg/ha seed were targeted to both the low yield/high ryegrass zone and also the high yield/low ryegrass zone (Figure 1e). The remainder of the paddock was sown variable rate with 120 kg/ha seed targeted to the low yield/high ryegrass zone, 90 kg/ha seed targeted to the mid zone and 70 kg/ha seed targeted to the high yield/low ryegrass zone.

The paddock was sown on the 14th of May with Chara wheat into a canola stubble. The seeding equipment consists of a 16.5m Horwood Bagshaw PSS Scaribar on 222mm spacings with a Horwood Bagshaw 10t twin bin box. The seeder is controlled by a Topcon X20 controller. GPS is supplied to the controller from a John Deere Greenstar RTK receiver that is also controlling the autosteer.

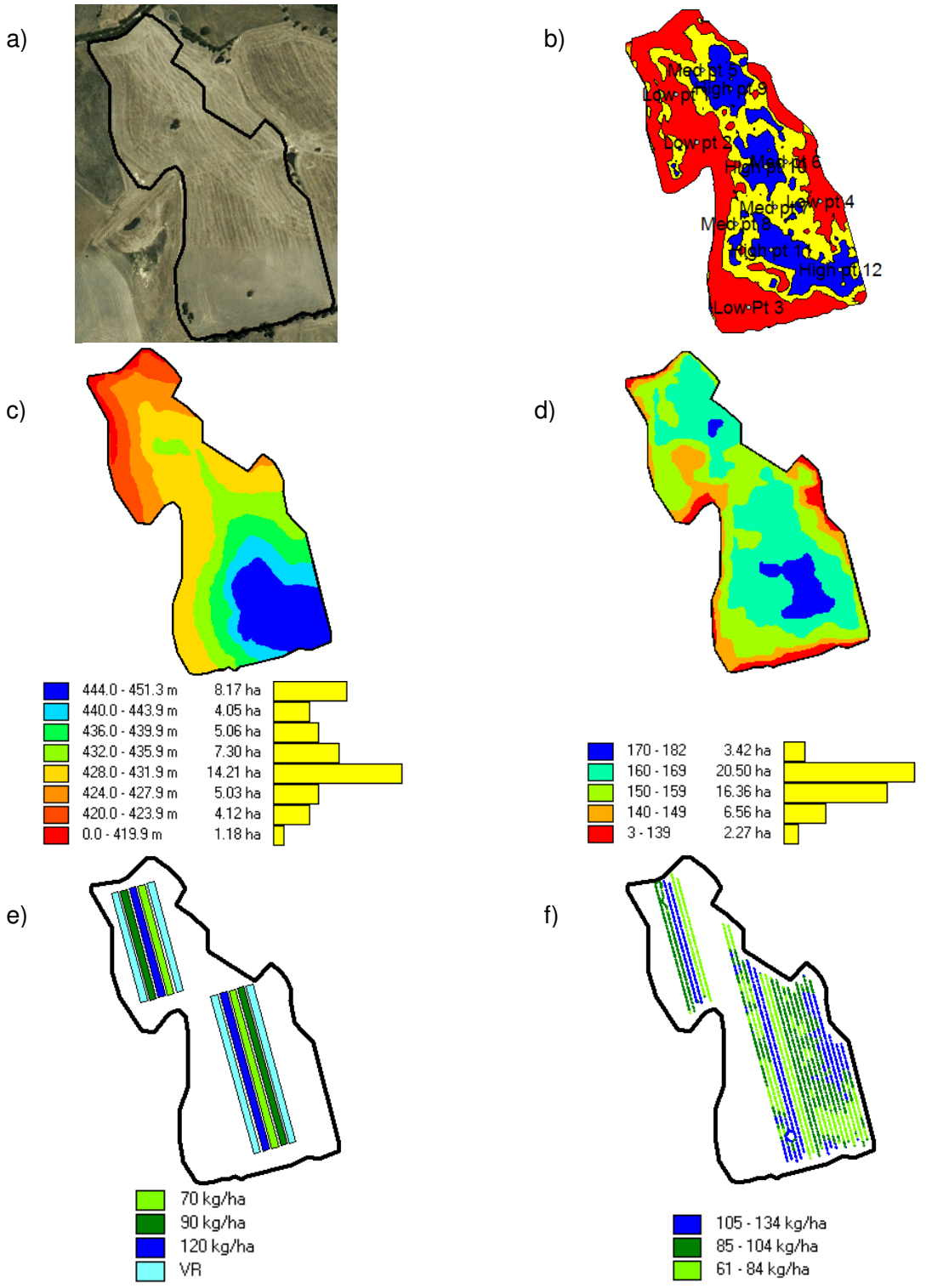

Figure 1 a) Google earth image of the paddock, b) a composite map generated in Apex from three years yield data, and overlaid with soil sampling points. Blue represents high yield zone and red low yield zone, c) elevation collected with yield map in 2010, d) Composite Landsat map using images from years 2000, 2001, 2002, 2004, 2005, 2006 and 2007, e) Seed rate trial strips targeted to high and low ryegrass density, f) As applied seed rates recorded on the Topcon X20 for the 1st half of the paddock sown.

Assessments:

Soil tests
Wheat & ryegrass head counts
Grain yield

Results:

In addition to the seed rate trial, soil tests were targeted to the three zones to help understand the yield and crop growth differences between zones and also to identify any potential opportunities for variable rate fertiliser, lime or gypsum. The results show some significant differences between zones (Table 1 & 2), including

- Very high P levels in low yield zone, and relatively lower (but still adequate) P levels in the high yield zone.
- Low - Medium PBI (phosphorous buffering index) values meaning that most of the P is plant available.
- Relatively lower Potassium in low yielding zone.
- Relatively lower Sulphur in high/medium yield zones.
- Over the 0-60 depth the low yield zone is slightly sodic, with ESP (exchangeable sodium percentage) greater than 6.

Table 1: soil test results for the 0-10cm depth targeted to yield production zones.

Yield Zone	Depth	Colwell P	PBI	Colwell Potassium	Organic Carbon	Conductivity	pH Level (CaCl2)	pH Level (H2O)	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	ESP (%)
		mg/Kg		mg/Kg	%	dS/m	pH	pH	meq/100g	meq/100g	meq/100g	meq/100g	
Low	0-10	91	58	106	1.64	0.194	6.10	6.70	8.52	0.79	0.28	0.35	3.5
Medium	0-10	81	59	179	1.91	0.219	6.00	6.60	11.22	1.46	0.46	0.46	3.4
High	0-10	54	57	152	2.21	0.185	5.80	6.40	11.00	1.23	0.29	0.33	2.6

Table 2: soil test results for the 0-60cm depth targeted to yield production zones.

Yield Zone	Depth	Nitrogen (kg N/ha)	Sulphur (kg S/ha)	Conductivity (dS/m)	pH Level (CaCl2)	pH Level (H2O)	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	ESP (%)
Low	0-60	101	130	0.115	6.60	7.30	6.84	2.94	0.18	0.85	7.9
Medium	0-60	125	63	0.175	7.00	7.80	12.76	5.90	0.30	1.19	5.9
High	0-60	117	61	0.208	7.20	7.80	12.44	3.61	0.28	0.66	3.9

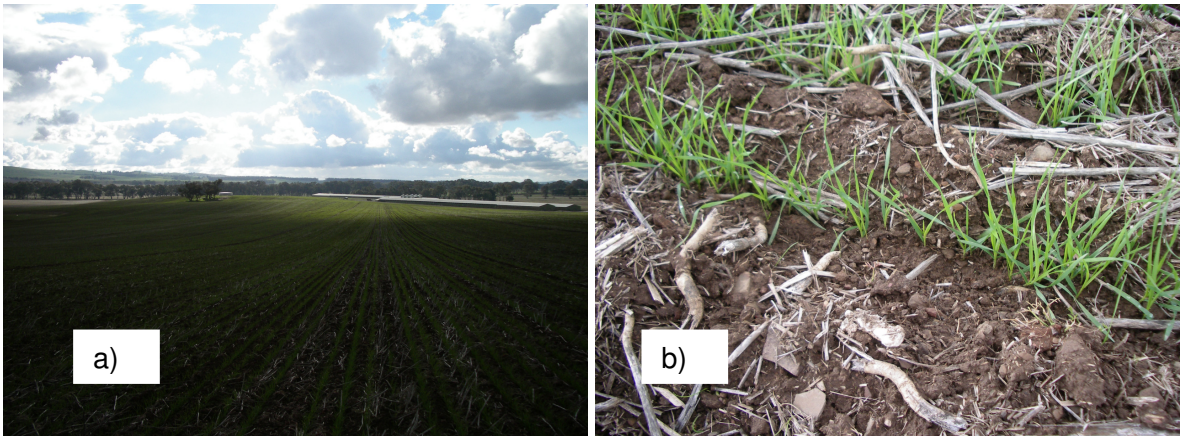

Figure 2 a) view North along trial strips in the high yield zone at crop emergence, b) crop establishment in the 120 kg/ha seed treatment in the high yield zone.

Ryegrass was at higher densities in the low yield zone as predicted by the growers. However, it was still present at high numbers in the high yield zone. Ryegrass and wheat head counts were taken at maturity from the 70 and 120 kg/ha seed treatments in the high yield zone only (Table 3). These show that the higher sowing rate did help to reduce ryegrass head numbers, subsequently helping to reduce potential ryegrass seed set, however there was still significant numbers present in both treatments. The higher seeding rate also produced more wheat heads, although the difference is small as a result of the crops compensation through more tillers and heads/plant.

Table 3: Wheat and ryegrass head counts.

Seed (kg/ha)	Yield Zone	Ryegrass (heads/m^2)	Wheat (heads/m^2)
70	High	230	500
120	High	162	533

Yield responses from the trial strips indicate no penalty for the higher sowing rate in either the high or low yield zone. In fact the higher sowing rates were generally higher yielding, particularly in the low yielding zone (Figure 3b, 4 & 5). This indicates that the improved competitiveness of the higher seed rate treatments enabled these treatments to yield more in the presence of ryegrass. There was a concern that high seed rates might 'hay off' and reduce yields in a dry spring, but this was not observed with the wet spring experienced in 2010.

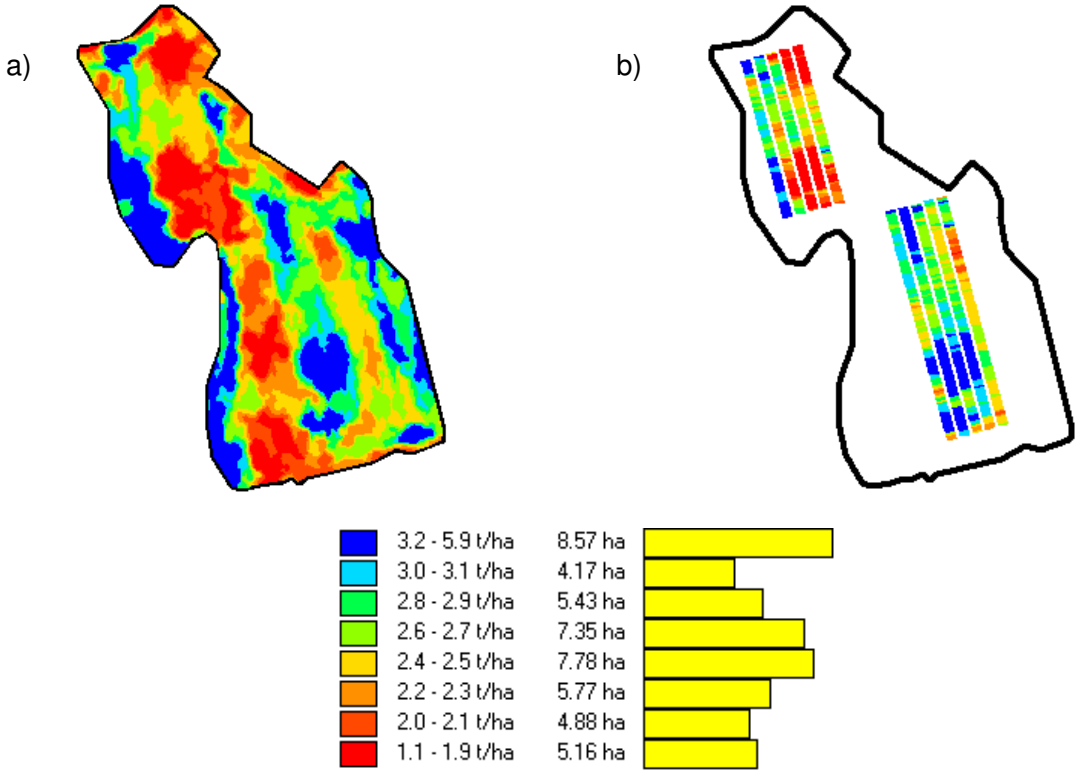

Figure 3 a) 2010 wheat yield map, b) yield of individual trial strips.

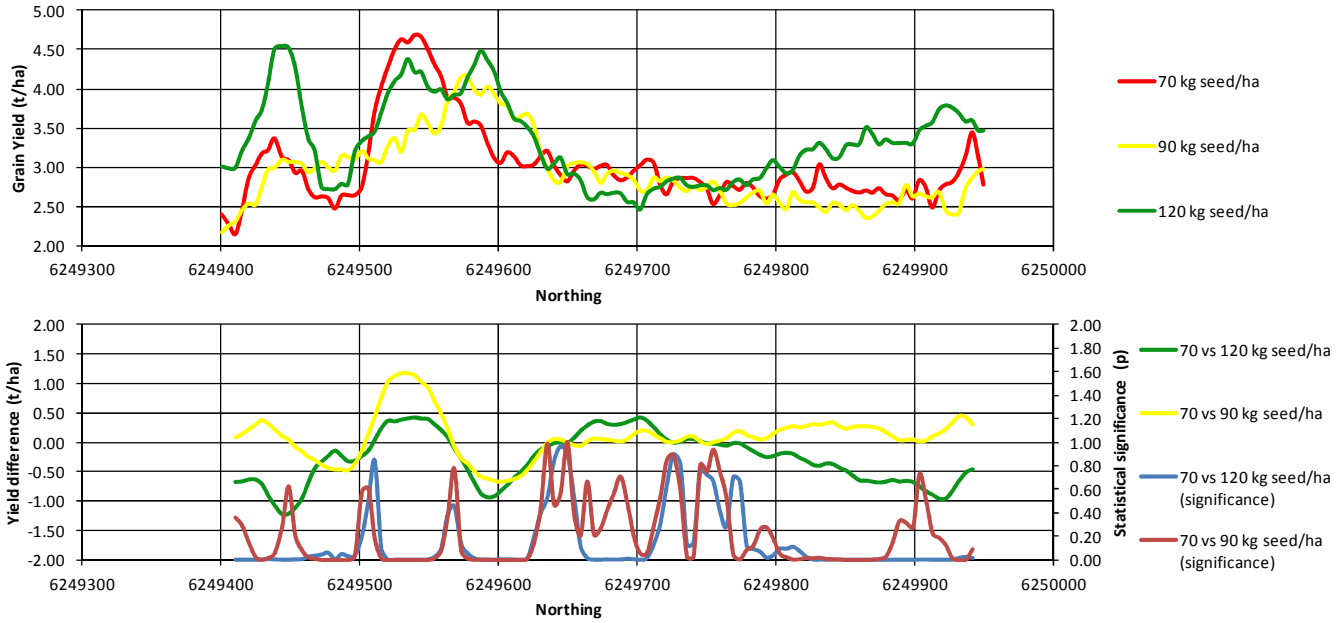

Figure 4 a) High yield zone trial strip yields, plotted against Northing, b) the difference in grain yield between 70 kg seed/ha and the adjacent strips of 90 and 120 kg seed/ha and the statistical significance of those differences. $P < 0.05$ indicates a statistically significant yield difference.

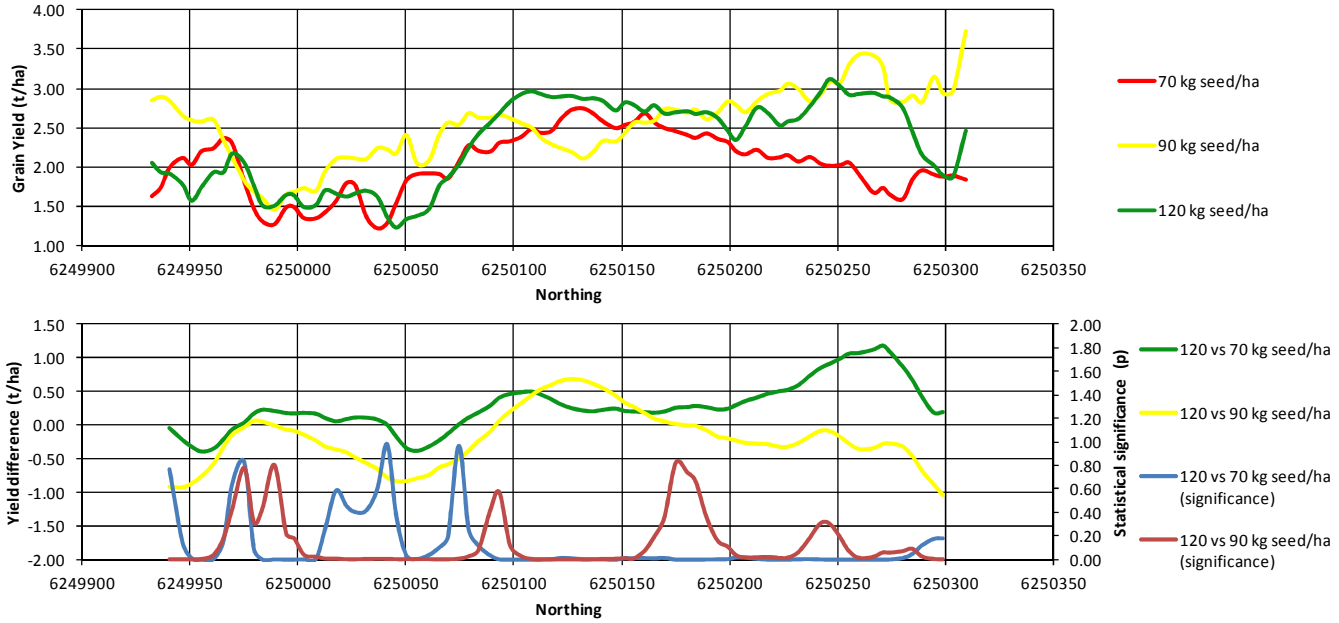

Figure 5 a) Low yield zone trial strip yields, plotted against Northing, b) the difference in grain between 120 kg seed/ha and the adjacent strips of 70 and 90 kg seed/ha and the statistical significance of those differences. $P < 0.05$ indicates a statistically significant yield difference.

Who was involved?

Craig and Grant Jaeschke
Leighton Wilksch (Landmark) supplied compiled historical Landsat data.
Sam Trengove (Trengove Consulting) coordinated the trial and completed the trial analysis.

Grower/Regional feedback:

The trial was easy to implement by the grower with the as applied data recorded on the Topcon X20 showing exactly where rates had been changed in the trial strips.

In 2011 the Jaeschke's used the variable rate seed approach on a number of paddocks, targeting more seed to their problem weed areas. Typically rates were varied between 80 and 100 kg/ha for wheat seed.

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