Precision Ag Trials

Variable Rate Fertiliser
NR & CR Kernick Coonalpyn/Field
Upper South East

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 in the Upper South East region from season 2010.

Aims:

- To compare the effects and to demonstrate the economic benefits that may result from the use of variable rate fertiliser applications by broad acre farmer trial.

Background:

Parts of the Upper South East have great variation in soil types from low fertility, poor structured sand through to heavier loams and water logging clays. Yield potentials from these soil types are vastly different, regardless of climatic conditions. The property selected for the trial has extremely variable soil types, with up to 3 distinct soil types being present in any one paddock.

The trial paddock selected has 3 very distinct soil types present across the 70.4Ha's

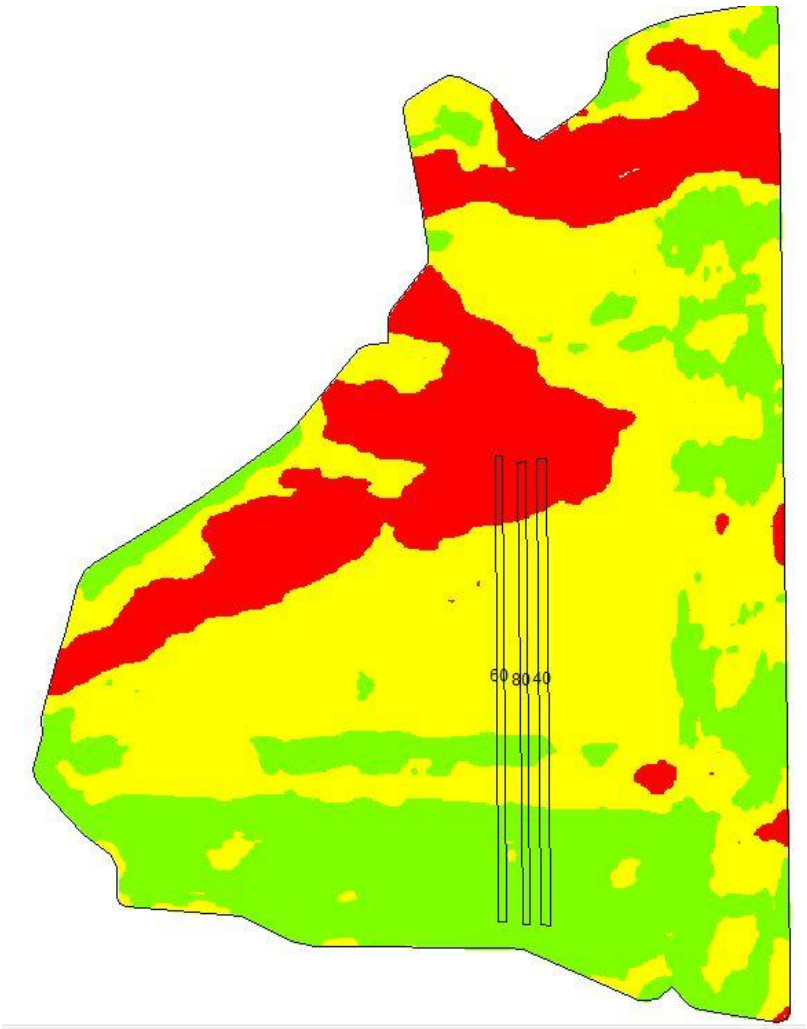
1. The first soil type is low fertility sand. As the paddock is undulating, the sandy soil type is predominantly present on top of hills/rises.
2. The second soil type is a loose limestone/rubble. This soil type is present mid slope ascending from the sandy rises/hills.
3. The final soil type is heavy loamy sand over clay or limestone.

About the trial:

The trial was carried out at Neville & Celia Kernicks property at Field, SA (15KM West of Coonalpyn). The paddock selected for the trail was sown to Canola in 2009, therefore the canola yield was used as the background layers for the analysis of yield response by fertiliser rate across the canola yield zone.

Using the canola yield as background layers, 3 different soil zones were identified and selected for the trial. The zones identified were;

- Zone 1(Low): Low fertility sand, low yielding 0-1t/ha (14.58 Ha)
- Zone 2(Med): Limestone/ rubble, medium yielding 1-2t/ha (34.57 Ha)
- Zone 3(High): loam over clay, high yielding 2-3t/ha (21.18 Ha)



The 3 different rates of fertilizer (DAP) applied to the above zones were;

1. Rate 1: 40kg DAP
2. Rate 2: 60kg DAP
3. Rate 3: 80kg DAP

The above fertiliser rates were selected after discussing with farmer that the lower yielding zones would never produce yields comparable to medium and high yielding zones, due to the low fertility and poor water and nutrient holding capacity of the soil. The farmer believed that that fertiliser was being wasted on the sand zones of his farm, and wanted to see if cutting fertiliser rates would be detrimental to yield in this zone.

Machinery Used

The machinery used was a VR ready Horwood Bagshaw airseeder rate controlled by Topcon X20, DAP fertiliser rates were applied manually in full length strips across the 3 yield zones on the 23rd May with Correll wheat @ 110kg/ha.

Seeding Trial Paddock

Winter Crop Walk at trial site

Assessments:

1. Soil test at seeding
2. Leaf tissue test GS14-23
3. Grain analysis
4. Yield analysis

Results:

1. Soil test (at seeding)

Soil Analysis		Low Yield	Med Yield	High Yield
Phosphorus Colwell	mg/Kg	17	24	27
Ammonium Nitrogen	mg/Kg	3	1	1
Nitrate Nitrogen	mg/Kg	5	8	16
Potassium Colwell	mg/Kg	27	87	74
Sulphur	mg/Kg	2.17	3.97	7.27
Organic Carbon	%	0.69	1.01	1.05
Conductivity	dS/m	0.016	0.1	0.126
pH (CaCl2)	pH	5	7.5	7.5
pH H2O	pH	5.8	8.3	8.2
PBI		5.4	32.7	31.4
Moisture	%	1.17	6.1	7.41

Soil test results show the extreme difference between the low yielding zone vs. the medium and high yielding zone with all analysis results. The difference between the medium and high zones is not dissimilar to each other from the soil analysis.

2. Leaf tissue test GS14-23

Leaf Tissue Analysis		Low Yield 40kg DAP	Low Yield 60kg DAP	Low Yield 80kg DAP	Med Yield 40kg DAP	Med Yield 60kg DAP	Med Yield 80kg DAP	High Yield 40kg DAP	High Yield 60kg DAP	High Yield 80kg DAP
Phosphorus	mg/kg	6400	6600	5900	3600	3700	3800	4700	4400	4500
Potassium	mg/kg	16200	11200	12600	35000	34000	31000	35000	32000	31000
Manganese	mg/kg	119	147	132	41	32	33	69	40	40
Sulphur	mg/kg	4900	4800	5000	4000	4000	4200	4000	3900	3900
Copper	mg/kg	6.6	6.0	5.9	4.5	4.4	4.0	3.6	3.9	3.4
Zinc	mg/kg	48	51	47	43	39	36	35	36	34

There is no obvious difference between leaf tissue test for the 3 fertiliser rates, however higher levels of nutrients are present in the low yielding (sand) zone, but this is most likely to be caused by the plants growth stage being Z14 compared to the plants from the medium & high yielding zones being Z23. Some small difference is also observed in the manganese levels in medium yielding zone being slightly less than the low and high yield zones.

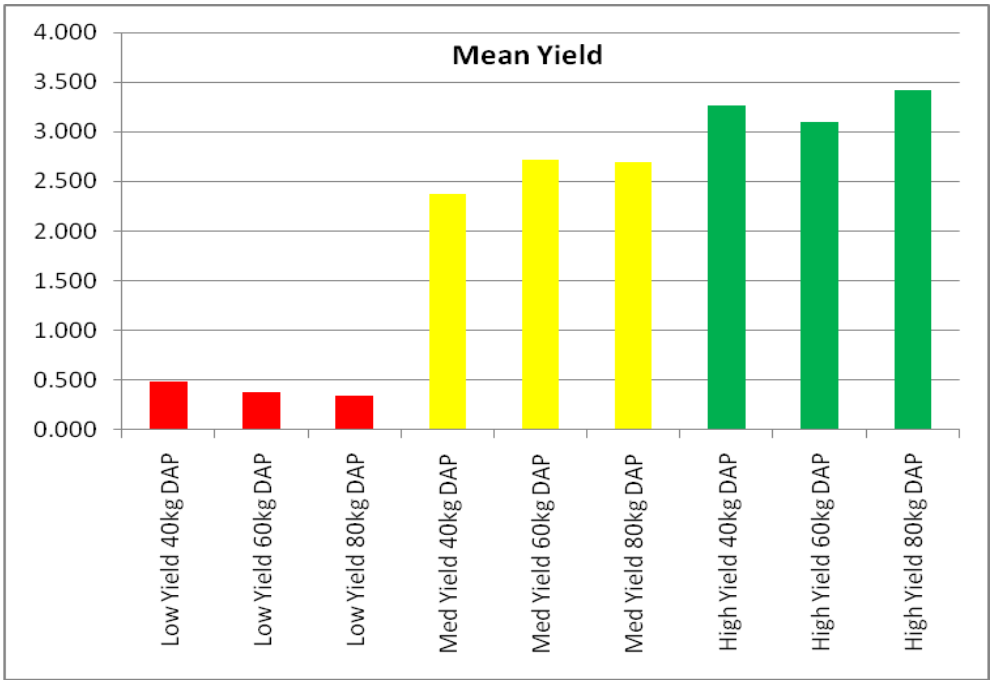
3. Grain sample analysis

Grain Analysis		Low Yield 40kg DAP	Low Yield 60kg DAP	Low Yield 80kg DAP	Med Yield 40kg DAP	Med Yield 60kg DAP	Med Yield 80kg DAP	High Yield 40kg DAP	High Yield 60kg DAP	High Yield 80kg DAP
Phosphorus	%	0.25	0.3	0.3	0.24	0.22	0.23	0.21	0.23	0.2
Potassium	%	0.34	0.33	0.34	0.36	0.34	0.33	0.35	0.38	0.32
Manganese	mg/kg	21.07	30.63	29.26	8.73	6.85	8.23	18.19	12.26	17.88
Copper	mg/kg	2.87	2.38	2.03	2.18	2.97	3.03	1.72	1.83	1.45
Total N	%	2.07	2.43	2.26	1.75	1.74	1.92	1.71	1.66	1.7
Zinc	mg/kg	23.63	28.51	28.88	19.31	19.97	22.18	19.51	16.92	18.08

Grain sample analysis showed no significant difference between phosphorus levels with the 3 fertiliser rates. Manganese levels appear to be lower in the medium yielding zone, possibly suggesting that the medium yielding zone could be manganese deficient causing the change between the high and medium yield zones.

4. Yield

Yield Analysis	Low Yield 40kg DAP	Low Yield 60kg DAP	Low Yield 80kg DAP	Med Yield 40kg DAP	Med Yield 60kg DAP	Med Yield 80kg DAP	High Yield 40kg DAP	High Yield 60kg DAP	High Yield 80kg DAP
Area(ha)	0.0592	0.0696	0.054	0.3352	0.266	0.2648	0.1764	0.1692	0.1552
Mean	**0.481**	0.371	0.341	2.371	**2.714**	2.693	3.269	3.102	**3.416**
Median	0.417	0.282	0.288	2.316	2.630	2.673	3.274	3.172	3.456
Std Dev	0.182	0.210	0.149	0.821	0.802	0.854	0.255	0.530	0.362
Minimum	0.131	0.163	0.171	0.399	1.094	0.863	2.643	1.937	2.242
Maximum	0.942	1.302	0.836	4.039	4.547	4.279	4.825	4.183	4.109

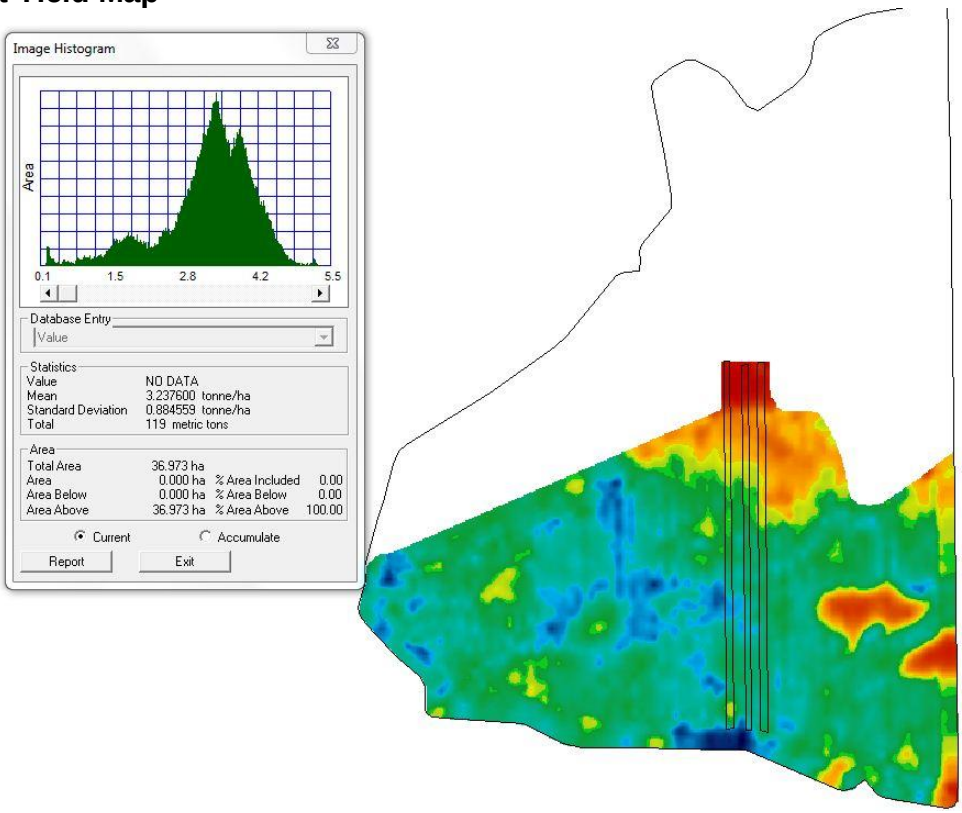


Yield analysis was completed by Felicity Turner from Vision Ag.

Results (as shown from the table and graph above):

- Low yielding zone yielded highest with the low (40gk DAP) fertiliser application
- Medium yielding zone yielded highest from the medium (60kg DAP) fertiliser application.
- High yielding zone yielded highest from the high (80kg) fertilise application.

2010 Wheat Yield Map



Standard 80kg/ha	Ha	Ave Yield/zone	Grain Harvested	Fert		Gross Margin
Zone 1	0.8	0.341	0.3	80kg/ha	0.064	
Zone 2	19.6	2.693	52.8	80kg/ha	1.568	
Zone 3	16.5	3.416	56.4	80kg/ha	1.32	
	36.9		**109.4t grain**		**2.95t fert**	
		$300/t Wheat	**$ 32,826**		**$ 2,007**	**$835/Ha**

Variable Rate	Ha	Ave Yield/zone	Grain Harvested	Fert		Gross Margin
Zone 1	0.8	0.481	0.4	40kg/ha	0.032	
Zone 2	19.6	2.714	53.2	60kg/ha	1.176	
Zone 3	16.5	3.416	56.4	80kg/ha	1.32	
	36.9		**109.9t grain**		**2.53t fert**	
		$300/t Wheat	**$ 32,983**		**$ 1,719**	**$847/Ha**
			Wheat $300/t DAP $680/t			**$12.07/Ha**

Paddock Records

30th March	Baited - 5kg Pestmaster
18th April	Knockdown spray – AMS, spray aid, LV Ester 680, Striker, Roundup P/Max
23rd May	IBS spray – Triflur X, Avadex, Gramoxone, Wetter
23rd May	Seeding – Correll wheat 110kg, DAP 80kg
1st July	Rolled
8th July	Spray – Citric acid, potassium nitrate, mangasol, zincsol, wetter
4th Aug	Spread – Urea 50kg
29th Aug	Sprayed – Mangasol, zinc, copper, Tilt, clopyralid, Ester 680
31st Aug	Streamed – Easy N 75L
23rd Sep	Sprayed – Mangasol, copper, Blast, wetter
17th Aug	Aerial – Meta 8kg
10th Jan	Harvested

OUTCOMES FROM TRIAL

The results indicate that the land owner may see economic benefit (as per Gross Margin) from the uptake of variable rate technology in paddocks with varying soil types such as this trial paddock.

ADDITIONAL BENEFITS FROM THE TRIAL

An additional benefit from the trial is that evidence suggests that the second zone may have been slightly distorted due to the Manganese levels being low, not the soil type or water holding capacity of the soil.

Who was involved?

SA Training & Consulting used the services of Felicity Turner from Vision Ag throughout the trial process for data collection, field work and result analysis.

This project was funded by the Grains Research and Development Corporation (GRDC).

For more information

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