Precision Ag Trials

Variable Rate Phosphorus
Brad Williams Cooke Plains
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 demonstrate the economic benefits that may result from the use of variable rate Phosphorus applications by broad acre farmer trial

Background:

The property selected for the trial has some variable soil types, with up to 4 different soil types being present in any one paddock.

The trial paddock selected has varying soil types present across the 31.89Ha's. In general, the Cooke Plains region has large areas affected by salinity, some sandy rises, sandy loam over clay and heavier loams.

The trial was conducted over 2 predominant soil types that would represent majority of Cooke Plains soil types:

1. The first soil type is lower fertility sand, predominantly on small rises.
2. The second soil type is sandy loam over clay to heavy loam.

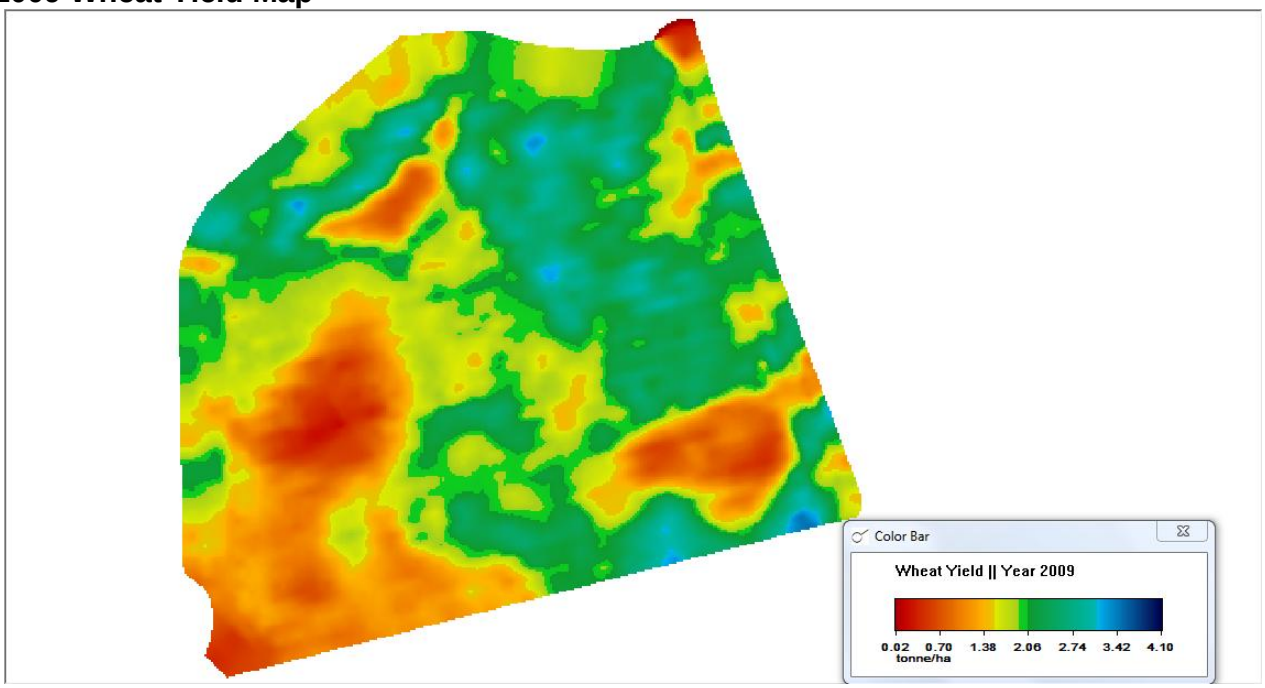
About the trial:

The trial was carried out at Brad & Barry Williams property at Cooke Plains, SA, 3Kms West of township. The paddock selected for the trail was sown to Wheat in 2009, therefore the wheat yield was used as the background layers for the analysis of yield response by phosphorus rate across the wheat yield zone.

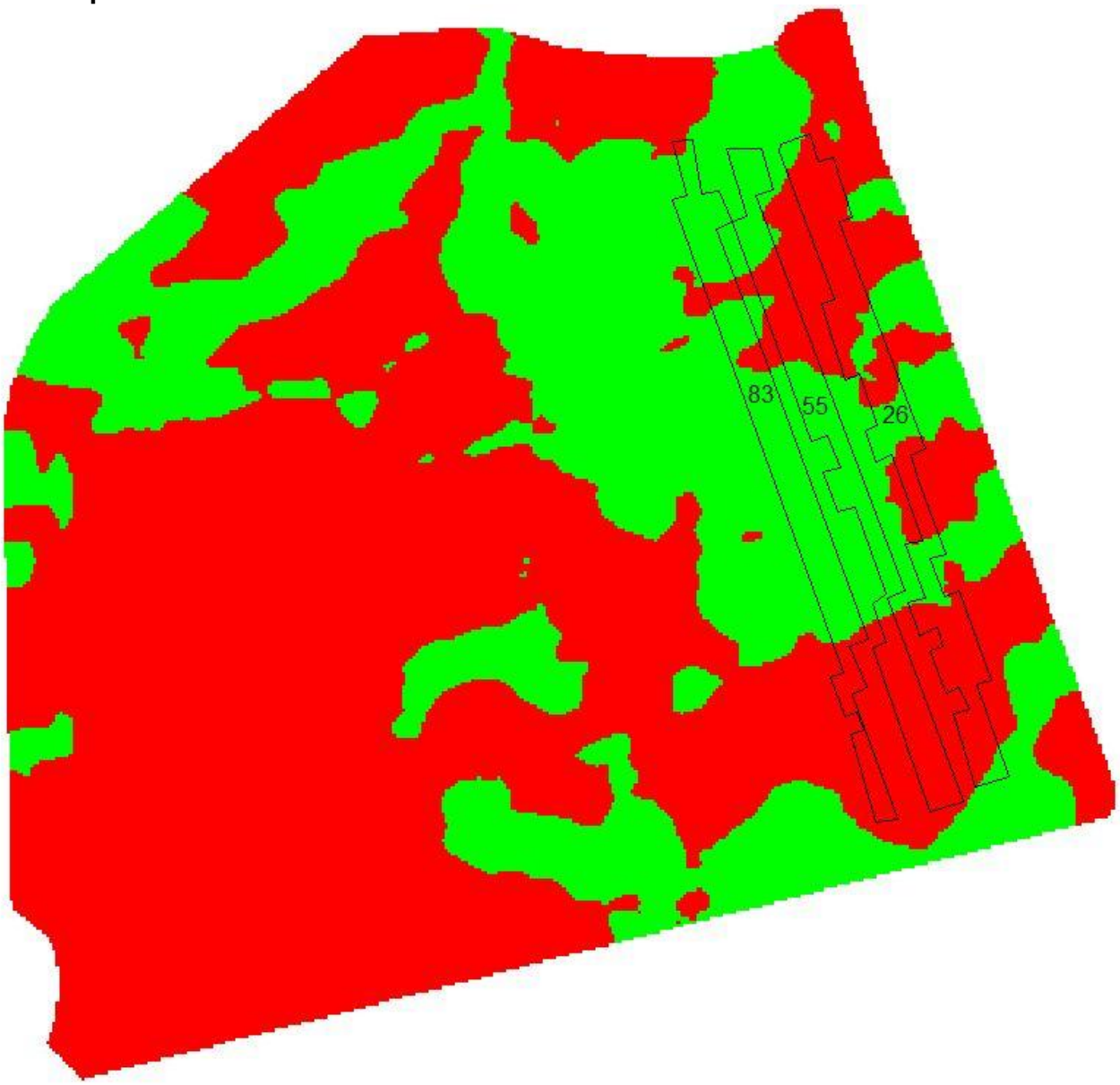
Using the Wheat yield as background layers, 2 different soil zones were identified and selected for the trial. The zones identified were;

1. Zone 1: Low yielding 0-2t/ha (20.66 Ha) Mean yield – 1.4t/ha
2. Zone 2: High yielding 2-3.5t/ha (11.23 Ha) Mean yield – 2.4t/ha

2009 Wheat Yield Map



Zone Map & Trial Plots

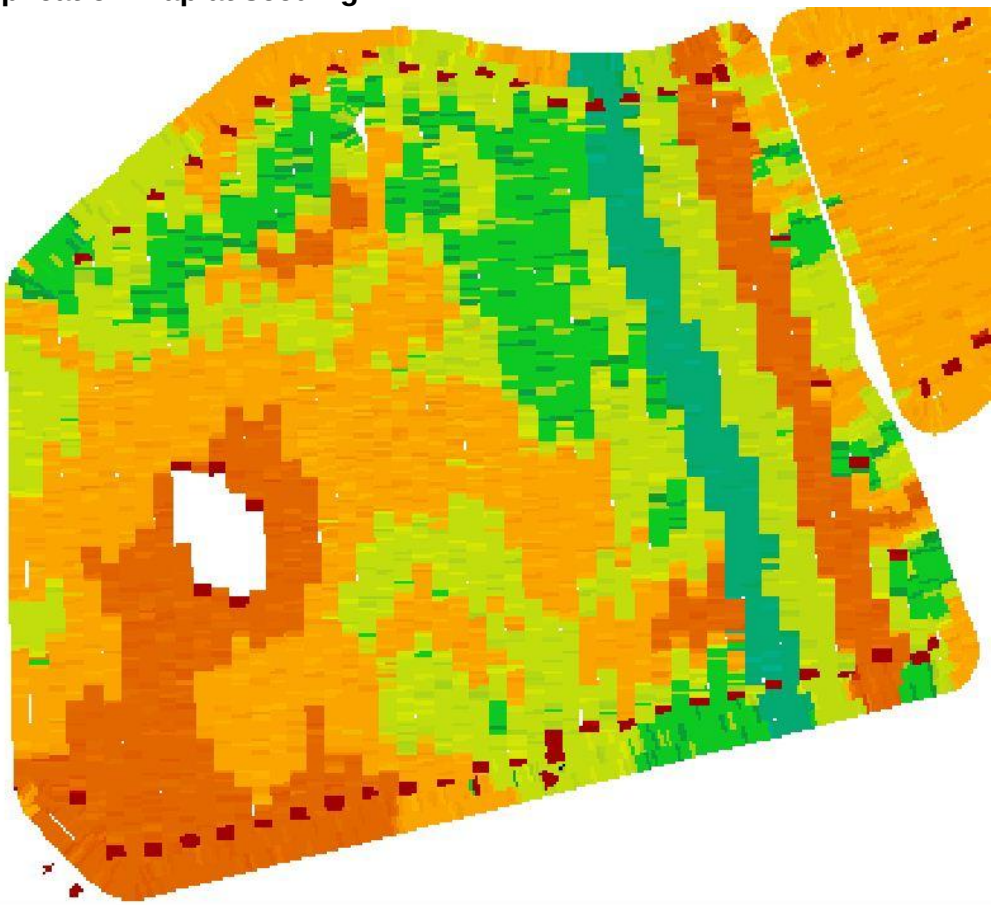


The 3 different rates of Phosphorus (DAP) applied to the above zones were (keeping N as a constant at 15Kg's across all zones);

1. Rate 1: 26kg DAP : 22kg Urea 5.2kg P : 15kg N
2. Rate 2: 55kg DAP :11kg Urea 11.0kg P : 15kg N
3. Rate 3: 83 kg DAP : 0kg Urea 16.6kg P : 15kg N

The machinery used was a Morris airseeder controlled by Topcon X20. DAP & urea fertiliser rates were applied automatically from an application map created by Felicity Turner – Vision Ag. in full length strips across the 2 yield zones in May to Flagship barley @ 70kg/ha.

Fertiliser application map at seeding



Trial site

Assessments:

1. Soil analysis
2. Leaf tissue test GS23-26
3. Grain analysis
4. Yield analysis

Results:

1. Soil Analysis

Soil Analysis		Low Yield	High Yield
Phosphorus Colwell	mg/Kg	91	42
Ammonium Nitrogen	mg/Kg	19	1
Nitrate Nitrogen	mg/Kg	78	27
Potassium Colwell	mg/Kg	1239	257
Sulphur	mg/Kg	733	38.8
Organic Carbon	%	3.2	1.06
Conductivity	dS/m	2.8	0.209
pH (CaCl2)	pH	5.4	7.4
pH H2O	pH	5.8	7.9
PBI		78.9	36.5
Moisture	%	20.7	8.21

Soil test sampling points were taken from a different area of the paddock than the trial location due to the incorrect file being used for seeding (2009 VR map was selected not 2010). This has therefore skewed the results from the soil test. The low yielding zone soil test points were sampled near a swamp/salty flat.

2. Leaf tissue test (GS 23-26)

Leaf Tissue Analysis		Low Yield 26kg DAP	Low Yield 55kg DAP	Low Yield 83kg DAP	High Yield 26kg DAP	High Yield 55kg DAP	High Yield 83kg DAP
Phosphorus	mg/kg	4100	3200	3600	5000	4500	4700
Potassium	mg/kg	52000	55000	55000	53000	54000	52000
Manganese	mg/kg	450	540	420	530	420	460
Sulphur	mg/kg	4000	5500	4700	3900	4000	3600
Copper	mg/kg	4.9	7.3	6.0	4.6	4.3	4.2
Zinc	mg/kg	164	210	150	194	146	162

Leaf tissue analysis results showed higher level of phosphorus levels present in the high yield zone compared to the low yield zone. This paddock has been under VR phosphorus applications for several years with higher levels of P being replaced on high yielding zones, that may explain the higher levels. Other nutrients show no significant difference between zones.

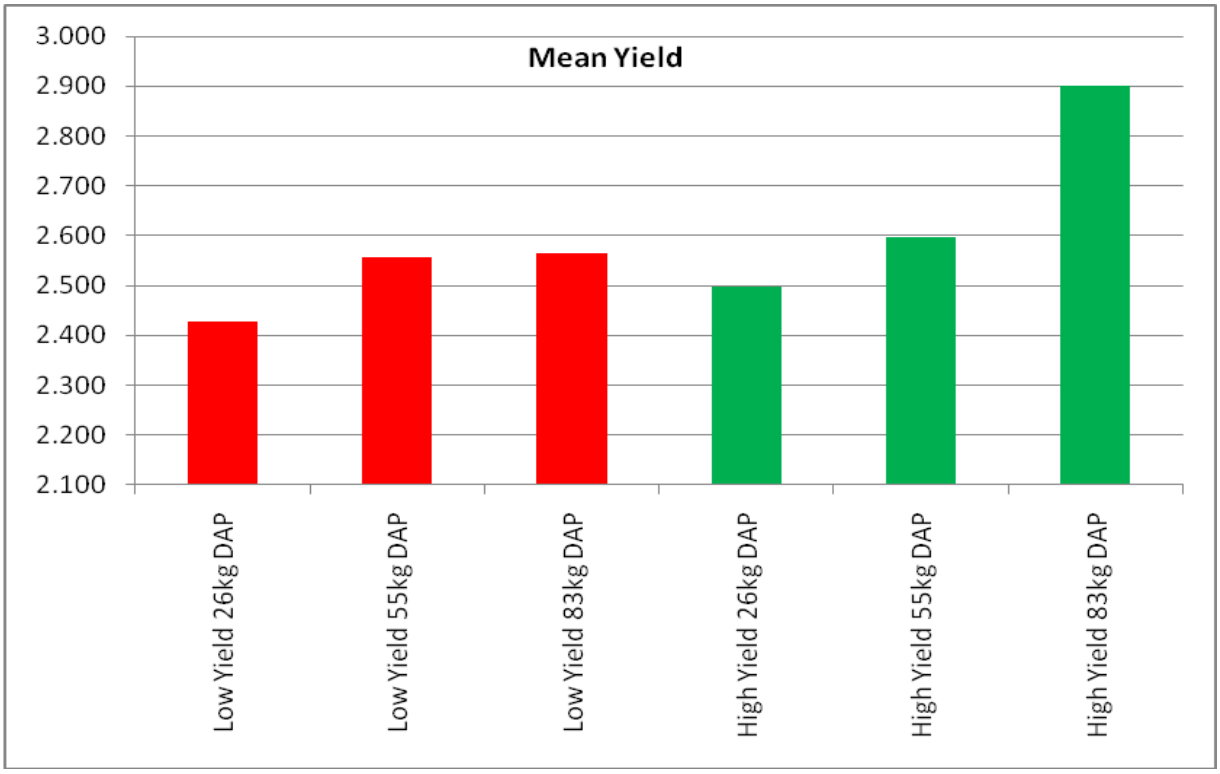
3. Grain analysis

Grain Analysis		Low Yield 26kg DAP	Low Yield 55kg DAP	Low Yield 83kg DAP	High Yield 26kg DAP	High Yield 55kg DAP	High Yield 83kg DAP
Copper	mg/kg	3.26	4.38	2.78	2.39	2.39	2.89
Manganese	mg/kg	15.61	18.56	16.29	13.3	13.4	15.16
Phosphorus	**%**	**0.27**	**0.31**	**0.37**	**0.3**	**0.28**	**0.3**
Potassium	%	0.47	0.51	0.53	0.47	0.46	0.46
Sulphur	%	0.1	0.12	0.11	0.09	0.09	0.09
Total N	%	1.8	1.68	1.49	1.48	1.38	1.31
Zinc	mg/kg	20.1	27.02	20.7	13.69	14.79	15.79

Grain analysis was taken soon before harvest. Results show no significant differences between zones or levels, other than an observation of Phosphorus levels increasing with rates of fertiliser in the low zone. This observation was not present in the high yield zone.

4. Yield

Yield Analysis	Low Yield 26kg DAP	Low Yield 55kg DAP	Low Yield 83kg DAP	High Yield 26kg DAP	High Yield 55kg DAP	High Yield 83kg DAP
Area(ha)	0.650	0.340	0.173	0.205	0.344	0.557
Mean	2.427	2.558	**2.565**	2.499	2.597	**2.900**
Median	2.473	2.632	2.657	2.493	2.666	2.982
Std Dev	0.580	0.741	0.668	0.529	0.689	0.764
Minimum	0.828	0.947	1.222	0.876	0.861	1.175
Maximum	3.454	4.501	3.878	3.858	4.238	4.839



Yield analysis shows very similar yields in the low yield zone regardless of the fertililser rate applied. The high yield zone indicates that the high phosphorus rate significantly increases yield.

Thus showing that if replacement P was applied over the paddock at a rate of 3.5kg/P per tonne from a 2.45t/ha wheat yield from 2009 (DAP rate 43kg/), the farmer would have experienced a potential loss of yield and economic loss of $25/ha (as shown below). Please note, for the purpose of the gross margin below, we have substituted the 43kg DAP fertiliser rate needed for paddock average replacement P with a 55kg DAP as used in the trial for accurate yield results.

2010		**Ha**	**Fert Rate**	**Total DAP (t)**	**DAP Cost**	**Urea**	**Total Urea (t)**		**Ave Yield/zone**	**Yield (total tonnes)**	**Gross Profit**
Scenario 1	Zone 1	20.7	55kg/ha	1.1t	$ 772.68	9kg/ha	0.2t		2.558	52.8t	
Ave yield, P replacement only	Zone 2	11.2	55kg/ha	0.6t	$ 420.00	9kg/ha	0.1t		2.597	29.2t	
		31.9			**$ 1,193**			**$ 153**	Ha	**82.0t**	**$ 22,964**
Scenario 2	Zone 1	20.7	55kg/ha	1.1t	$ 772.68	9kg/ha	0.2t		2.558	52.8t	
VR rate replacement	Zone 2	11.2	83kg/ha	0.9t	$ 633.82	0kg/ha	0.0t		2.9	32.6t	
		31.9			**$ 1,407**			**$ 99**	Ha	**85.4t**	**$ 23,916**

Assumptions	**Net Income after Fert**	Nett
Barley Price $280/t	Scenario 1	Difference
DAP Price $680/t	**$21,618**	**$793**
Urea $550/t	Scenario 2	**$24.86/Ha**
	$22,411	

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.

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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