Precision Ag Trials

Variable Rate Nitrogen

Coonalpyn, Upper South East 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 uptake 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 a minimum of 30% by 2013. This goal will be achieved by demonstrating the user friendly operating system of PA tools to growers along with increasing PA skills and knowledge base of growers and industry to a level where they can comfortably use PA tools in their farming systems to achieve economic, environmental and social benefits.

The trial sites and demonstrations are conducted on growers' properties and are monitored via on farm visits 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 report presents the outcomes of the SPAA trial 'Variable Rate Nitrogen in the Upper South East Region of South Australia from season 2011'.

Aims:

- To compare the effects of variable rate nitrogen applications on wheat yield across varying soil types

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 these typical variable soil types, with up to 4 distinct soil types being present in any one paddock. Fertiliser applications across the soil types are sometimes considered poorly placed inputs, or under/over fertilised zones.

The trial paddock selected has 4 soil types present across the 70Ha's

1. Low Yield Zone (sand) - The first soil type is low fertility non wetting sand. The sandy soil type is a sand hill that runs across the width of the paddock. This soil zone was clay spread in 2009 to help with the non wetting properties

2. Low Yield Zone (rock) - The second soil type is a reef rock hill with scatterd loose limestone.

3. High Yield Zone - The third soil type is a heavy loam over clay or limestone

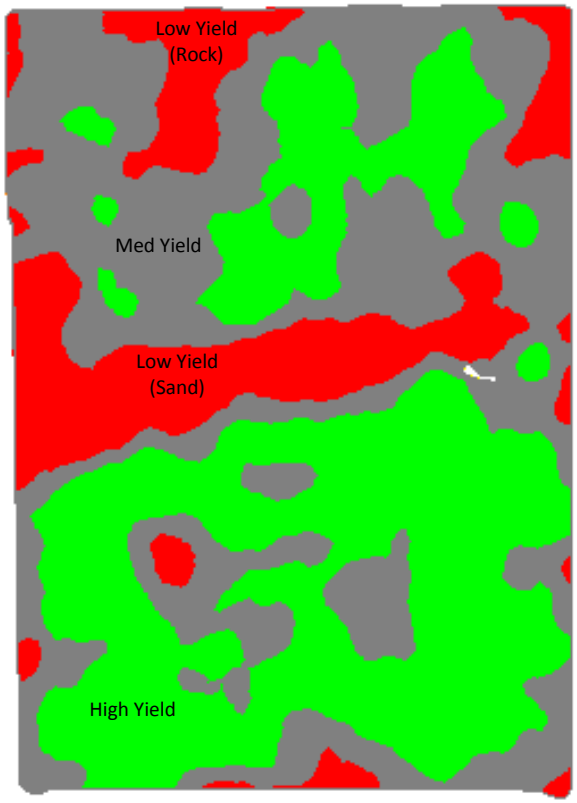
4. Medium Yield Zone - The final soil type is a combination of the 3 above soil types. This soil type is present mid slope ascending from the sandy rises/hills and mid slope of the rocky hill.

About the trial:

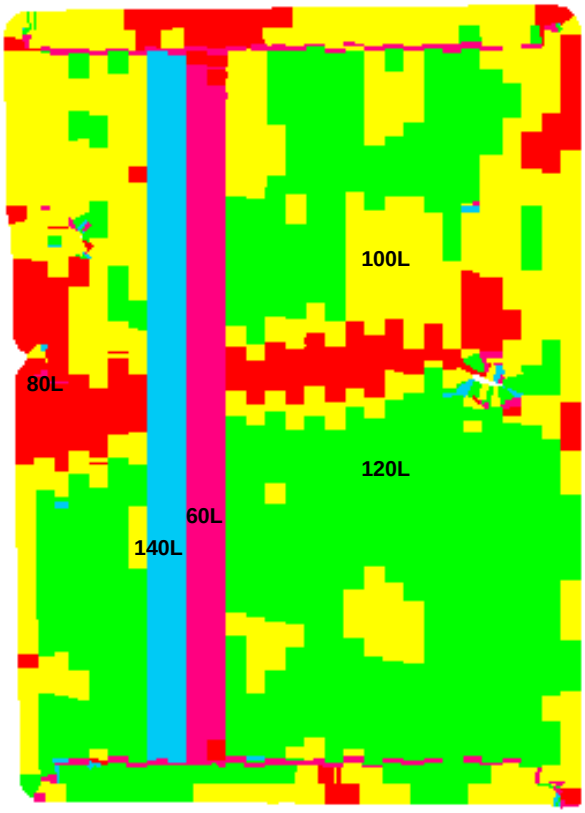
The trial was conducted at Coonalpyn in the Upper South East on the property of Aaron & Trent Long. The paddock was Canola stubble sown to Correll wheat at a rate of 80kg/ha with a custom blend fertiliser 16:11:8:8 @ 120kg on the 14th May, 2011 using a single shoot Flexicoil airseeder with knife points and press wheels.

Nitrogen was applied as UAN with streaming nozzles on the 4th of August 2011, according to 2009 Barley yield map. The 2009 Barley yield maps was used due to Barley having similar growth patterns as wheat, as opposed to the 2010 canola yield map yielding differently over the zones. Three zones were established and UAN was applied variable rate at 80L, 100L & 120L over the paddock, additionally two 'constant rate' strips of 60L & 140L were applied as the trial. Standard practice for the grower when growing wheat is 100L UAN at GS31-33.

2009 Barley Yield Map



2011 UAN Application Map



Equipment used

- Yield maps collected with New Holland CR harvester with sub meter accuracy in 2009, and collected with RTK accuracy in 2011.
- Prescription maps created with New Holland's Precision Farming Software (PFS) version 5.52.
- Maps imported into Green Star APEX version 3.2.1.206. as shape files from PFS
- UAN applied via Green Star 2600 screen connected to Raven 440 controller through Goldacres boomspray.
- NDVI maps collected through Trimble FMX and Greenseeker on a 4 wheel bike.

Assessments:

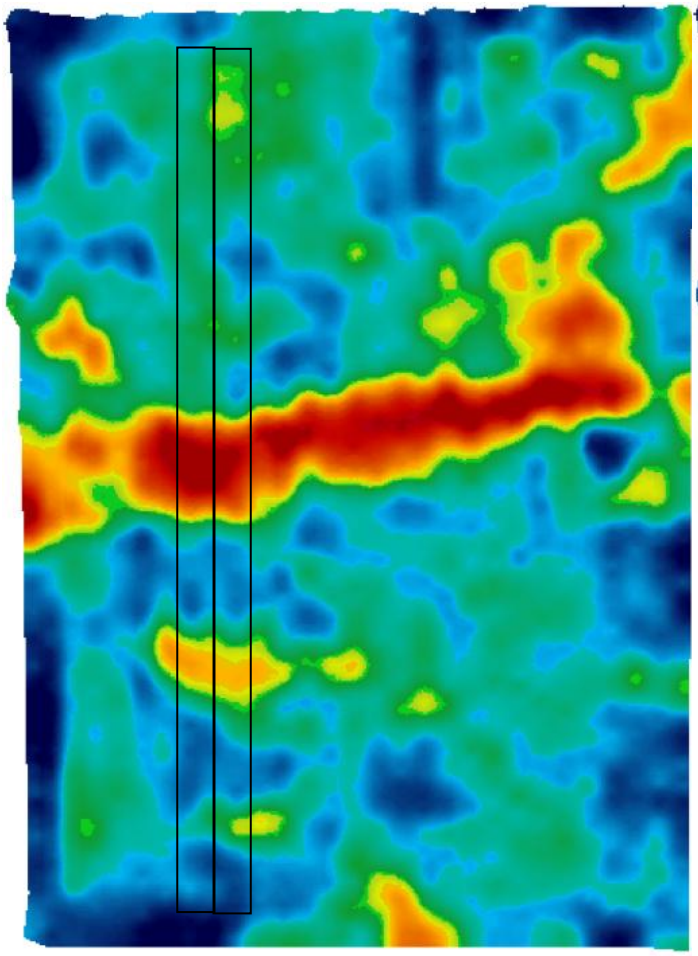
Soil Nutrient analysis
NDVI
Yield

Results:

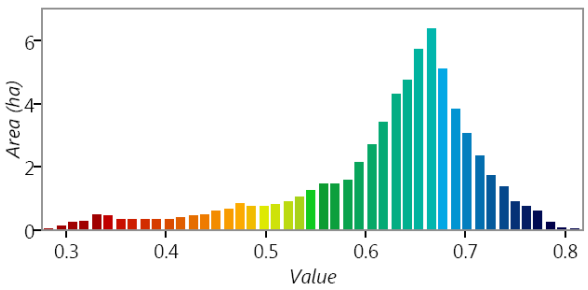
1. Soil test

Soil Analysis		Low Yield	Med Yield	High Yield
Phosphorus Colwell	mg/Kg	34	39	39
Nitrate Nitrogen	mg/Kg	12	15	29
Potassium Colwell	mg/Kg	89	224	256
Sulphur	mg/Kg	5.3	10.9	12.2
Organic Carbon	%	0.74	1.19	0.83
Conductivity	dS/m	0.073	0.13	0.099
pH (CaCl2)	pH	7.3	7.3	6.7
pH H2O	pH	8.3	7.9	7.7

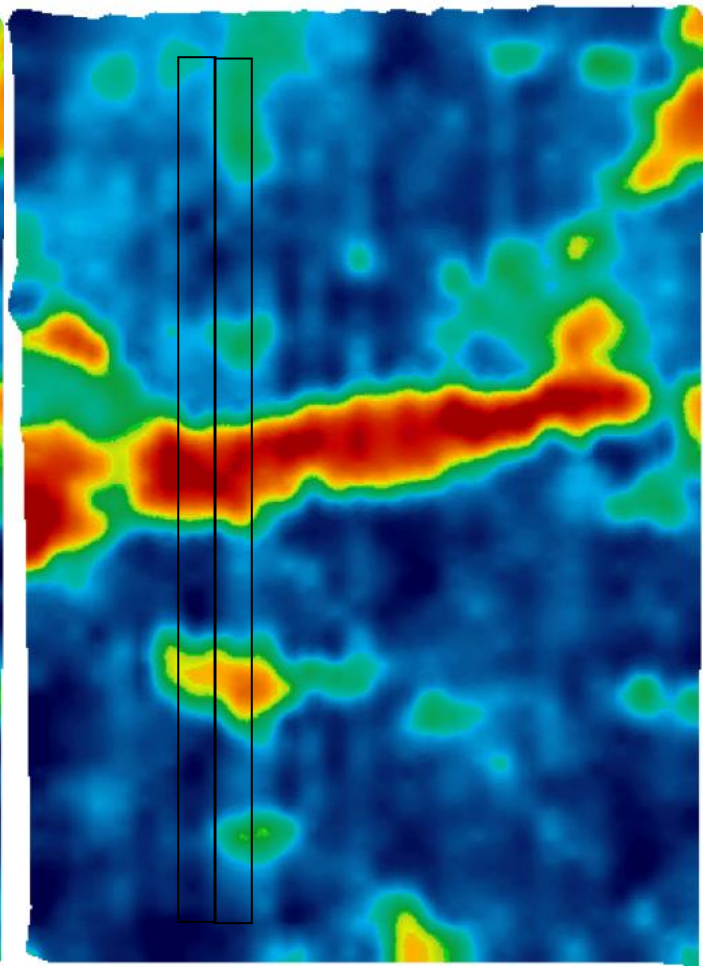
NDVI 4th August



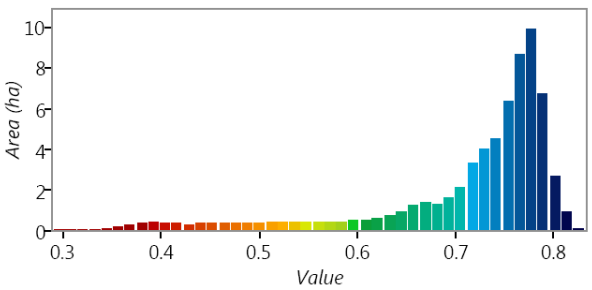
Mean 0.63



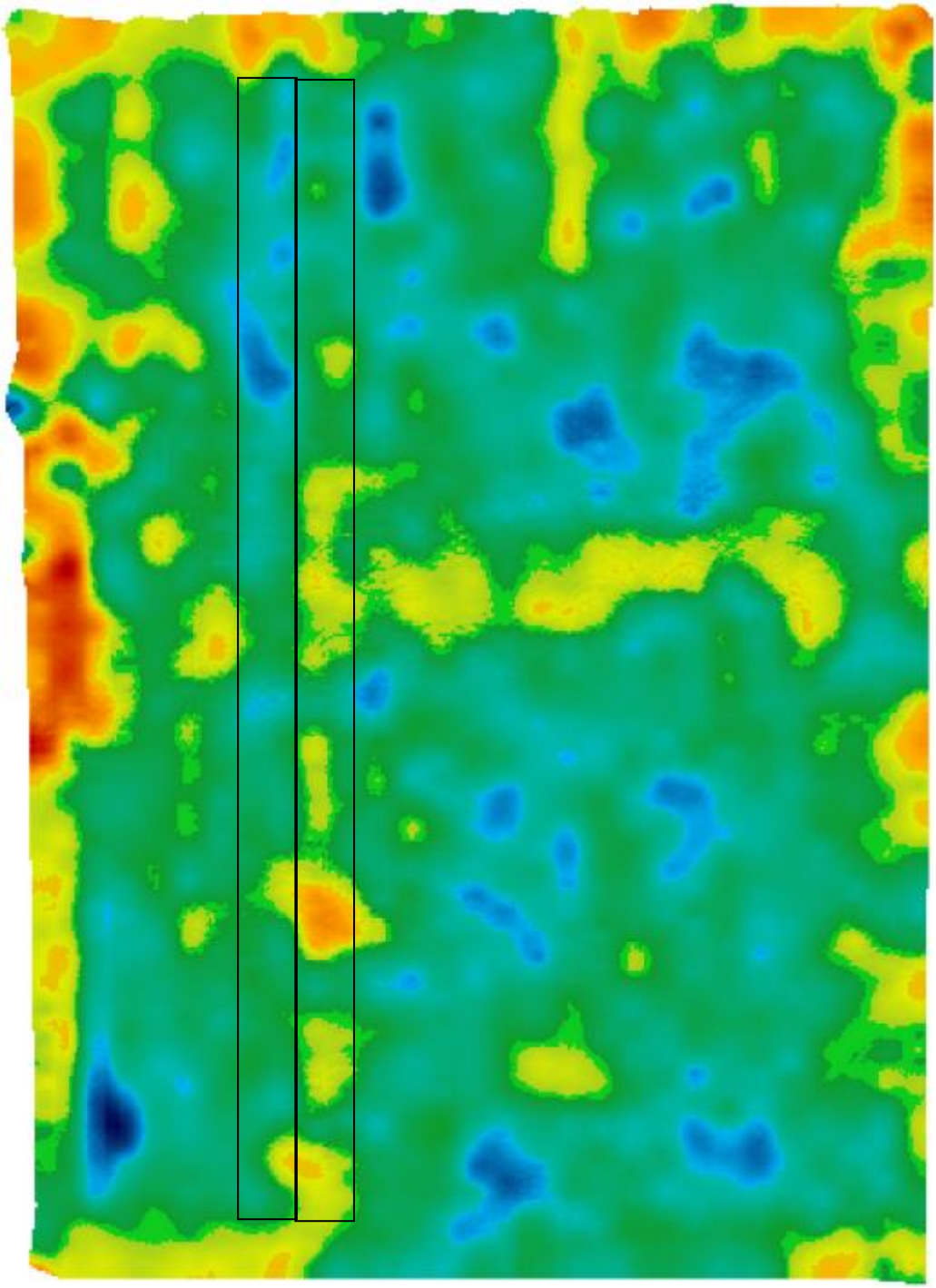
NDVI 19th September

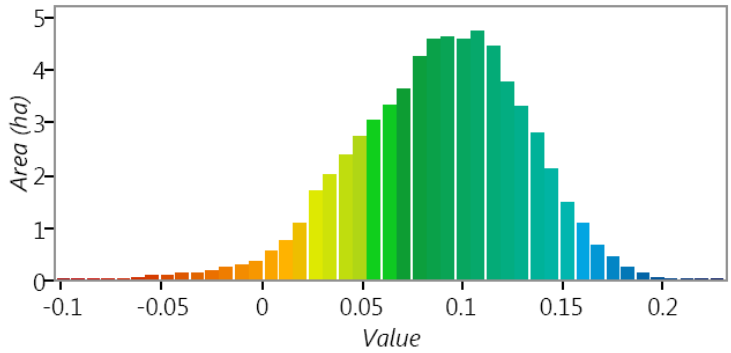


Mean 0.72

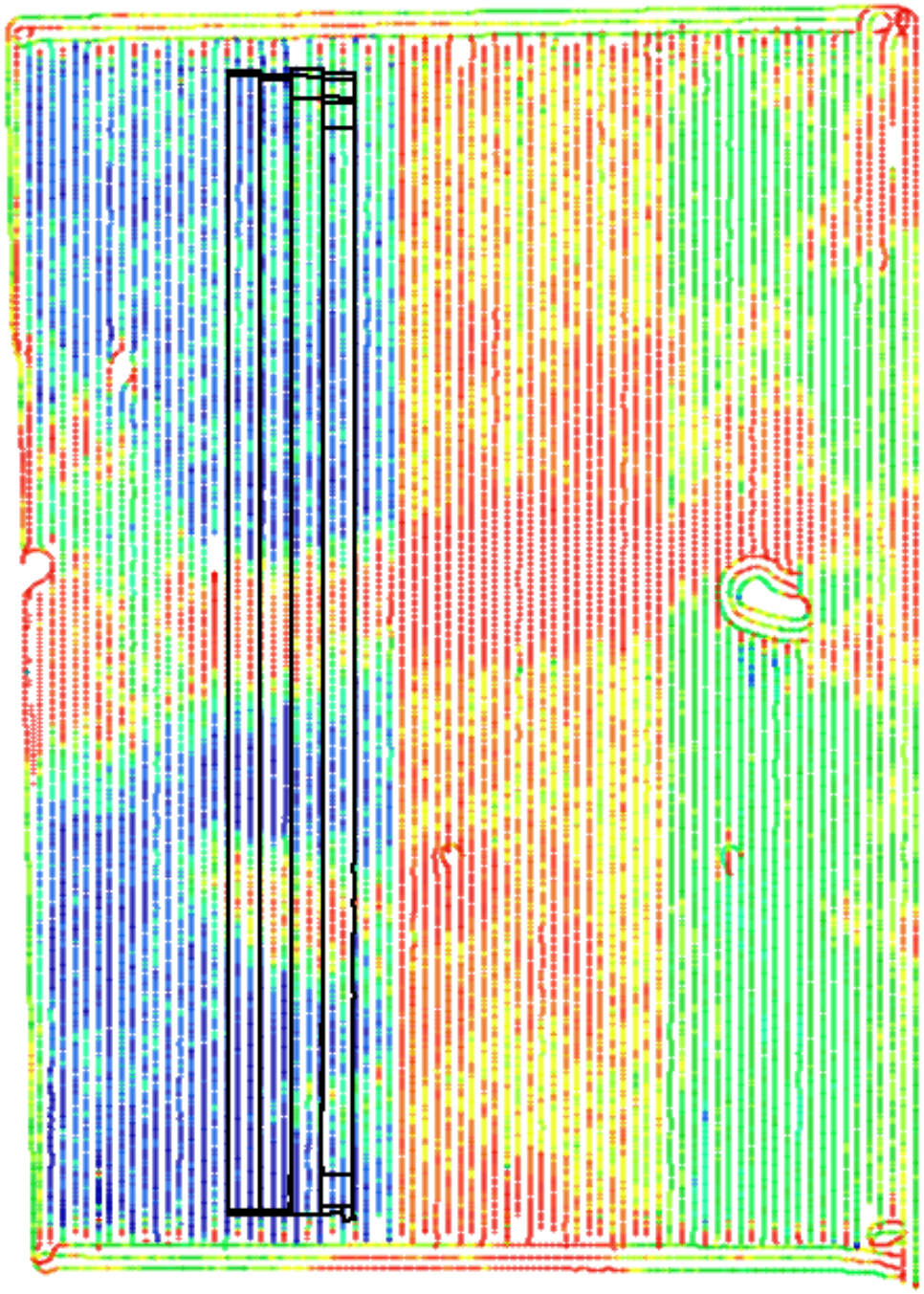


NDVI Change Map




5
4
3
2
1
0
Area (ha)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
Value

2011 Yield Map – please note help from a 3 year old daughter adjusted the header width mid paddock. All yield data for the trial has been recalibrated for actual yield.



Yield Results

		140L	60L	Yield Difference
Low Yield	Sand	**1.62**	**1.56**	**0.06**
Low Yield	Rock	**3.02**	**2.61**	**0.40**
Med Yield		**3.23**	**2.98**	**0.25**
High Yield		**3.78**	**3.28**	**0.50**

Gross Margin
Assumptions:

- UAN Pricing 78c/L
  - 140L UAN = $109/ha
  - 60L UAN = $47/ha

- Wheat $230/t

	Yield Difference (t/ha) High vs. Low	G.M. $/ha	Ha/Zone	$ gain/loss	$/ha gain/loss
Zone 1 Low Sand	0.06t/ha	$14.10	9.02ha	**-$436**	**-$48/ha**
Zone 2 Low Rock	0.4t/ha	$92.90	2.41ha	**$74**	**$30/ha**
Zone 3 Med	0.25t/ha	$56.87	30.96ha	**-$171**	**$5/ha**
Zone 4 High	0.5t/ha	$115.95	27.61ha	**$1,479**	**$53/ha**
				$945	**Income**
				$13.51/ha	**Average**

Whole Paddock Gross Margin

Assuming 'Medium Yield Zone' had 100L UAN applied and yielded an extra 125kg/ha (1/2 of the yield difference between the 60L & 140L plots)

Whole paddock income comparisons taking into account fertiliser costs and yield.

Income	VR over Paddock	140L over Whole Paddock	60L over Whole Paddock
Zone 1 Low Sand	$2,821	$2,385	$2,821
Zone 2 Low Rock	$1,338	$1,411	$1,338
Zone 3 Med	$19,711	$19,616	$19,787
Zone 4 High	$20,989	$20,989	$19,510
	$44,860	**$44,402**	**$43,457**

Whole Paddock Comparisons (from table above)

- Variable Rate vs. High Rate (140L)
  $457 - $7/ha (over 500ha wheat $3,500 extra income)

- Variable Rate vs. Low Rate (60L)
  $1,402 - $20/ha (over 500ha wheat $10,000 extra income)

- High Rate vs. Low Rate
  $945 - $13/ha (over 500ha wheat $6,500 extra income)

Whole paddock gross margin comparisons prove that Variable Rage Nitrogen can be economically viable in variable soil types such as the ones present throughout the Upper South East.

The extra income can be mostly put down to savings made from reducing $ spent on poor performing soils, such as the poorly structured non wetting sands. The trial has also confirmed to the grower, that the low yielding rocky section of the paddock has the potential to flip flop depending on the finish to the season. This was proven from results compared between the 2009 & 2011 growing seasons. The shorter finish to the 2009 growing season affected the barley yield map, however the wetter finish of the 2011 growing season allowed the wheat to continue to utilise the extra nitrogen in the shallow rock from the high rate being applied.

The trial has indicated that the application of the high rate UAN (140L/ha) over the entire paddock still proved to be a more profitable than applying the low rate over the entire paddock, however the overall gross margin benefits are not as visible due to the low yielding sand zone only occupying 9ha (13%) of the paddock. However these results confirm that the adoption of PA is an economically sound decision, indicating that the grower could make a saving of $48/ha if that extra nitrogen was not applied to the low yielding area via the use of variable rate fertiliser application.

The trial results have solidly indicated that the overall gross margin would be profitably affected not having to spend the extra $62/ha on fertiliser. The gain of $53/ha in the high yield zone with high rate N (140L) is a substantial increase in profit over the low rate (60L) showing there is benefits to adding N in these zones.

The High rate being applied over the entire paddock was still a more profitable decision than applying the low rate but the overall gross margin benefits are not as visible due to the low yielding sand zone only occupying 9ha (13%) of the paddock. If variable rate was used to apply the nitrogen there would have been an extra saving of $48/ha if extra nitrogen was not applied to the low yielding area. In a paddock with a greater area of low yielding zones, the overall gross margin would be greatly affected not having to spend an extra $62/ha on fertiliser.
The gain of $53/ha in the high yield zone with high rate N (140L) is a substantial increase in profit over the low rate (60L) showing there is benefits to adding N in these high yielding zones.

Who was involved?

Thanks to

- Felicity Turner Vision Ag for analysis of data
- Grant Yates for collection of NDVI data

Grower Feedback?

Aaron & Trent Long can seed some potential savings to be made from Variable Rate nitrogen, as well as other inputs over their paddocks with the common poor performing non wetting deep sand patches. Taking into account the cost of purchasing the variable rate equipment was only $150 for the extra cable from the Green Star 2600 screen to the Raven controller, the extra income made from variable rate nitrogen is worth the time and effort.

However, adding extra nitrogen to “high” yielding patches is still under investigation with more seasons of on farm trials to isolate true deficient zones that will benefit from added inputs.

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