Precision Ag Trials

Variable Rate Nitrogen

Tintinara, 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 diverse 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 that was selected for the trial has these typical diverse soil types, with up to four 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 56 Hectares.

1. Low Yield Zone (sand) - The first soil type consists of lower fertility sand in the top 0-20cm layer, with poorly structured clay in the 20-50cm depth and then becomes a more unstructured rubble from 50cm's and beyond.

2. Low Yield Zone (gravel) - The second soil type consists of a sandy loam layer within the top 0-20cm, then a more gravel type soil that does not perform well due to low water holding capacity in the 20cm range and beyond.

3. Medium Yield Zone – The third soil type consists of loamy sand in the top 0-10cm range with a more structured rubble/gravel type soil to 60cm with limestone from 60cm's and 60cm.

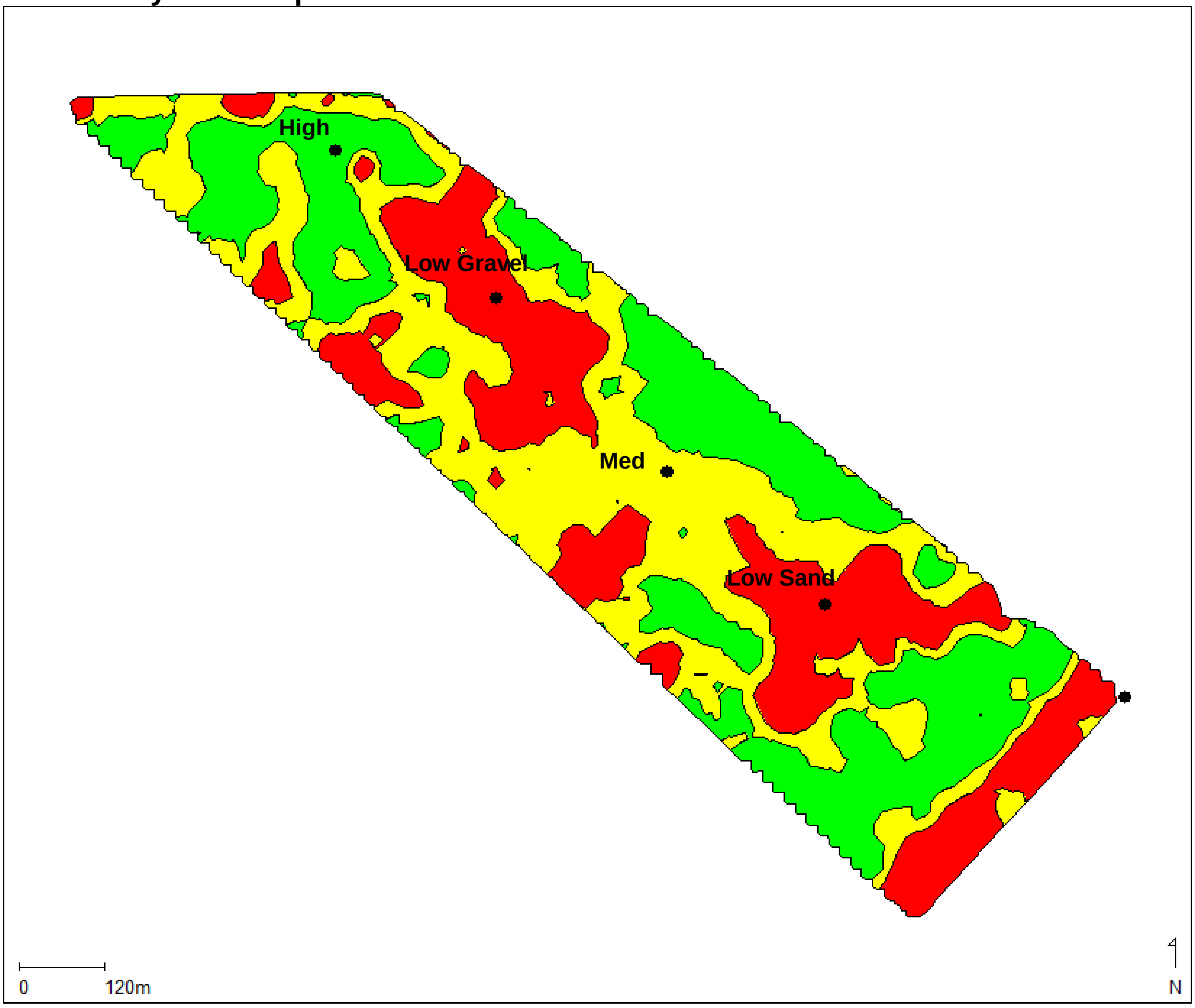
4. High Yield Zone - The higher yielding soil type consists of a loam in the 0-10cm with a structured clay over rubble/gravel.

About the trial:

The trial was conducted at Tintinara in the Upper South East on the property of Harkness family. The paddock was Canola stubble sown to Yitpi wheat at a rate of 92kg/ha, with DAP fertiliser @ 80kg/ha on the 7th June, 2011. The Harkness's use a Ausplow DBS airseeder with knife points and press wheels with a Topcon X20 seed rate controller and FWA New Holland tractor with Autofarm A5 RTK steering.

Nitrogen was applied as urea via the Harkness's Ausplow DBS airseeder bin fitted a "whale-tale" on the 10th of August 2011, when the wheat was at GS21-23 using the Topcon X20 rate controller. The urea was applied at 3 rates of 20kg, 60kg & 100kg in 2 X 40m strips per plot running full length of the 56 ha paddock covering the 4 yield zones. Standard practice for the grower when growing wheat is 64kg of urea at GS23-24 (mid tillering).

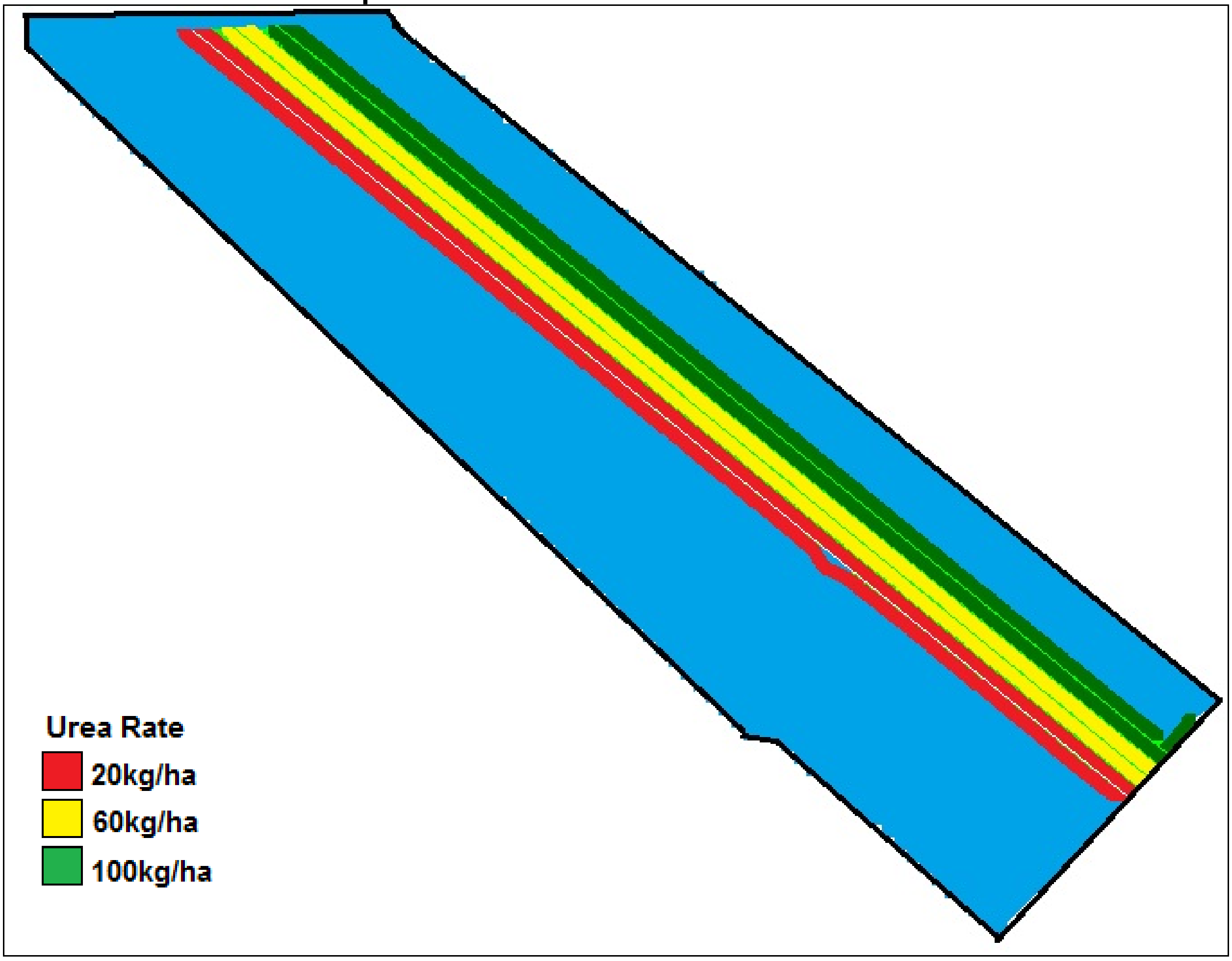
2009 Barley Yield Map



Equipment used

- Seeding & spreading with Ausplow DBS and Topcon X20 controller, behind the New Holland FWA with A5 Autofarm RTK steering
- Yield maps collected with Case 2388 harvester with Autofarm A5 RTK accuracy in 2009, and 2011.
- Prescription maps created with New Holland's Precision Farming Software (PFS) version 5.52.
- NDVI maps collected through Trimble FMX and Greenseeker on a 4 wheel bike.

Trial Paddock & Trial Strips



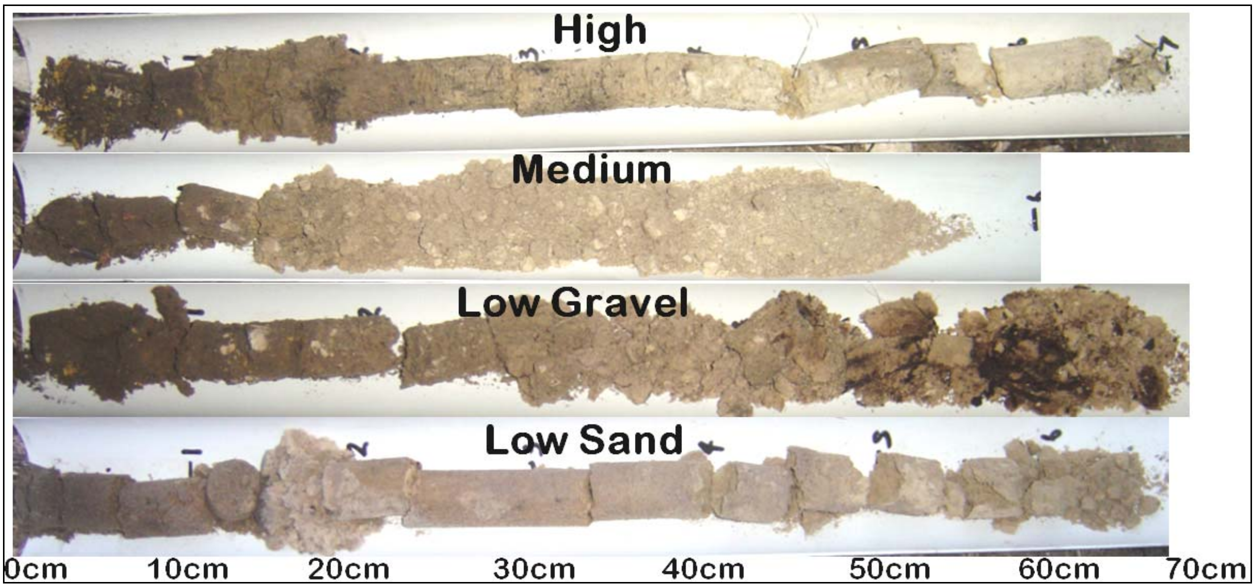
Ausplow DBS airseeder with Topcon X20 controller and Autofarm A5 RTK steering.

Ausplow DBS bin with whale tale with Topcon X20 controller, Autofarm RTK steering.

Case 2388 harvester with RTK

Assessments:

1. Soil Nutrient analysis
2. NDVI (Normalized Difference Vegetation Index)
3. Yield



Soil profile 0-70cm across 4 yield zones

Results:

1. **Soil Nutrient Analysis**

Soil Test 0-10cm

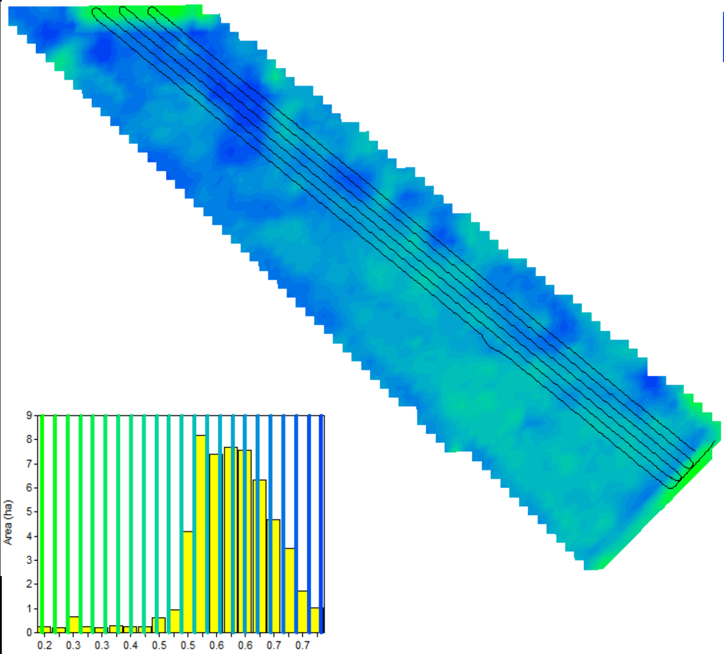
Soil Analysis		Low Sand 0-10cm	Low Gravel 0-10cm	Med Yield 0-10cm	High Yield 0-10cm
Phosphorus Colwell	mg/Kg	37	53	24	45
Nitrate Nitrogen	mg/Kg	11	43	16	11
Potassium Colwell	mg/Kg	360	960	448	565
Sulphur	mg/Kg	5	19.3	8.5	17.9
Organic Carbon	%	0.89	2.26	1.38	1.29
Conductivity	dS/m	0.085	0.222	0.149	0.156
pH (CaCl2)	pH	7.1	6.8	7.3	6.8
pH H2O	pH	7.9	7.8	8.1	7.8

Soil Test 10-60cm

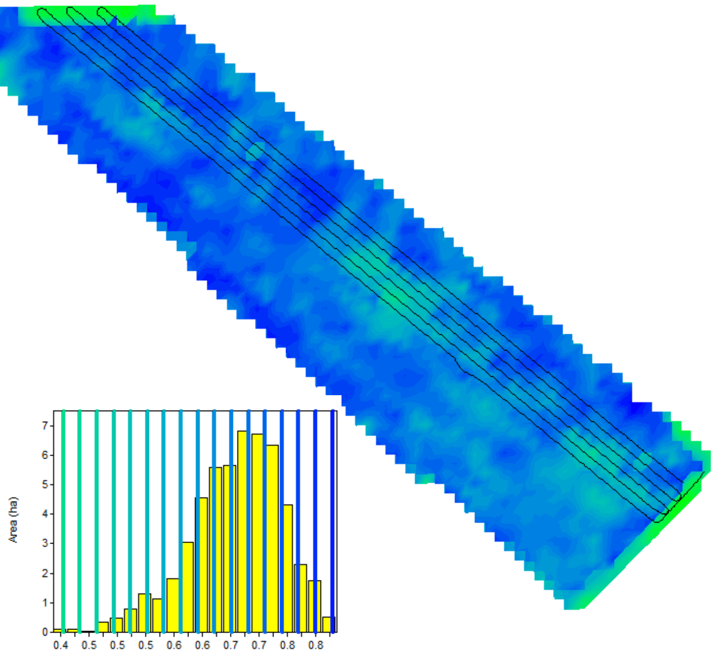
Soil Analysis		Low Sand 0-10cm	Low Gravel 0-10cm	Med Yield 0-10cm	High Yield 0-10cm
Phosphorus Colwell	mg/Kg	10	15	9	10
Nitrate Nitrogen	mg/Kg	19	94	31	44
Potassium Colwell	mg/Kg	183	422	164	561
Sulphur	mg/Kg	8.9	103.1	6.4	47.4
Organic Carbon	%	0.42	1.39	0.64	0.47
Conductivity	dS/m	0.145	1.169	0.141	0.794
pH (CaCl2)	pH	7.6	7.7	7.8	8.2
pH H2O	pH	8.5	8.6	8.7	9

2. NDVI

NDVI 4th August
Mean 0.59



NDVI 19th September
Mean 0.68



Average NDVI		
Fert Rate	Pass 1 Ave	Pass 2 Ave
20	0.61	0.64
60	0.62	0.67
100	0.62	0.7

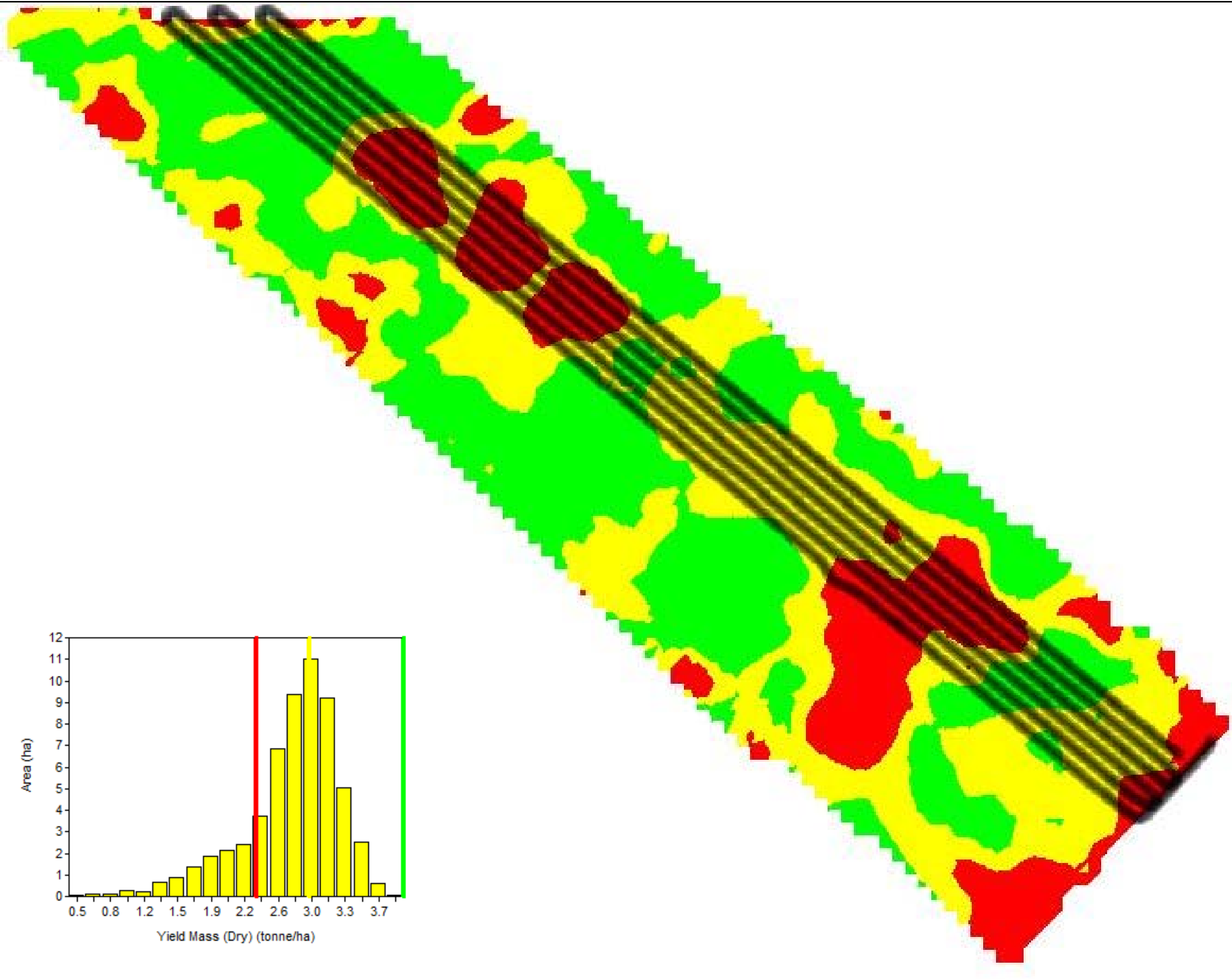
Minimum NDVI		
Fert Rate	Pass 1 Min	Pass 2 Min
20	0.31	0.46
60	0.3	0.49
100	0.26	0.55

Maximum NDVI		
Fert Rate	Pass 1 Max	Pass 2 Max
20	0.77	0.78
60	0.77	0.79
100	0.78	0.8

The Normalized Difference Vegetation Index (*NDVI*) results show that before the urea application, the NDVI levels were consistent across the 3 zone at 0.62. After the urea application, the average NDVI levels increased according to nitrogen rate.

The minimum NDVI table shows a significant increase in NDVI levels from the nitrogen application. In comparison, the maximum NDVI table shows that there was minimal increase in NDVI levels. These results indicate that the poorer parts of the paddock did respond to the nitrogen application but not all the paddock was nitrogen responsive, this backs up what the soil test showing to have nitrogen levels in all the yield zones.

This is also show in the NDVI histograms above that we lifted NDVI levels in the lower NDVI part of the paddock but did not increase the areas with already high NDVI.



3. Yield Results

		Low N 20kg	Med N 60kg	High N 100kg	Average Yield t/ha
Low Yield	Sand	2.68	2.56	2.61	**2.62**
Low Yield	Gravel	2.81	2.71	2.82	**2.78**
Med Yield		3.51	3.60	3.58	**3.56**
High Yield		4.04	4.04	4.03	**4.04**

As show by the above yield results table, unfortunately there was no response shown to varying Nitrogen rates across the 4 yield zones on this paddock. This could be due to the adequate levels of nitrogen present before seeding as show in the 0-10 and 10-60cm soil test results and also reinforced with the NDVI results, this would stem from good fertiliser history and rotation from the Harkness's.

Average paddock yield was 3.0t/ha

This could give confidence that rates could be reduced on the lower yielding areas without risk of impacting on yield and consequently increasing gross margins across the paddock by saving wasted inputs on poorer performing soil types and leaving rates higher on better performing areas to maximise returns when seasons are more favourable.

Who was involved?

Thanks to

- Harkness family and those involved on the farm for letting SPAA use their property for the trial
- Felicity Turner Vision Ag for analysis of data
- Grant Yates for collection of NDVI data

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