Precision Ag Trials

Evaluating Soil & pH mapping

Lake Bolac, Victoria

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 **Evaluating Soil and pH Mapping** from season 2010.

Aims:

- To understand the benefits of soil pH mapping and its interaction with other soil and crop maps
- To compare various layers of information (pH, elevation, EM-38, yield and satellite imagery) for understanding paddock variability

Background:

Farmers throughout South West Victoria are investigating the process of site specific crop management. This trial has focused on understanding soil pH and its impact on crop performance.

About the trial:

The trial paddock is located approximately 5km west of Lake Bolac, Victoria. We focussed on measuring paddock variability rather than implementing an actual variable rate trial.

Barley (Gairdner) sown 5th June 2010 with 70kg/ha MAP & 50l/ha UAN, harvested 11th February 2011

Spatial data included:

- Yield maps (2008 & 2010)
- EM38 (dual dipole) – data collected 10th February 2010
- Digital Elevation Models and Contour Maps – data collected 10th February 2010
- Satellite imagery (Sept 2009 & Oct 2010)

Assessments:

Soil sampling (collected 21st February 2010) included:

- Soil profiles & textures (0-100cm), 6 strategic samples based on EM38 map
- Basic nutrient tests, 6 strategic samples based on EM38 map
- Soil pH & EC (0-10cm), 13 samples based on 4ha grid,

Results:

The process of integrating multiple datasets with strategic soil sampling enabled the ability to generate a detailed understanding of paddock variability. The drivers of yield variability varied between the canola 2008 and barley 2010 crops. The poorer yielding areas from both years had a direct correlation with elevation, frost in 2008 and water-logging in 2010. Surface water management has the greatest potential for improving crop performance.

The variability found in the 0-100cm soil cores illustrates the complexity of truly understanding crop yield potential. The heavier textured sub-soils match up well with low yielding zones. The 0-10cm soil sampling found little evidence of factors driving influencing crop variability. These findings confirm the need for deep sampling when building knowledge required for variable rate management.

Soil pH mapping proved to be a valuable step towards variable rate lime with significant variability found, pH(CaCl2) varying from 4.0 to 7.1 across a 50ha paddock. A variable rate management approach to pH on this paddock would deliver a 75% saving of lime.

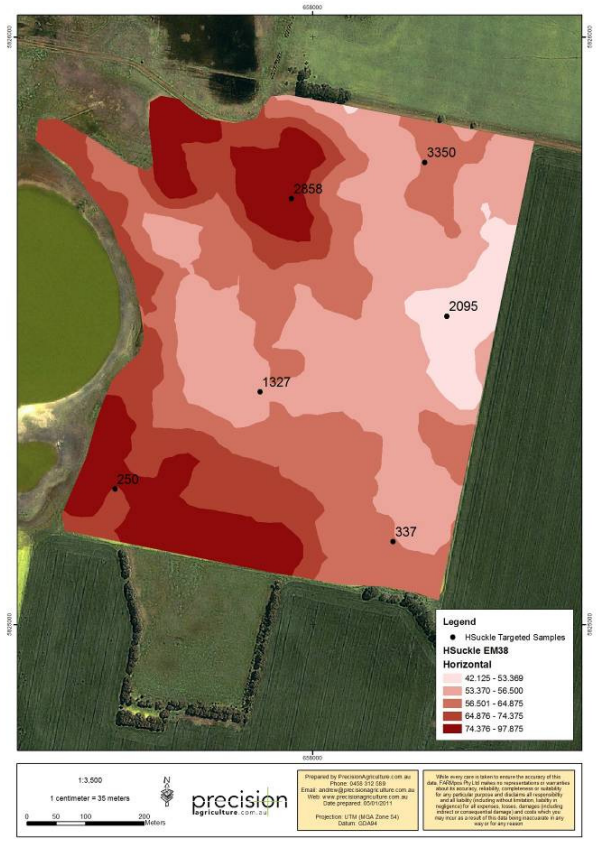


Image 1: EM38 (horizontal) map with locations of strategic soil samples

Sample ID	Depth	Colour	Gravel	Texture	Phosphorus Colwell	Potassium Colwell	Sulphur	Organic Carbon	Conductivity	pH Level (CaCl2)	pH Level (H2O)
			%		mg/Kg	mg/Kg	mg/Kg	%	dS/m	pH	pH
250	0-10	GR	0	3.0	41	942	10.70	3.99	0.171	7.60	8.50
337	0-10	DKBR	0	3.5	66	732	26.10	3.60	0.222	6.30	7.00
1327	0-10	DKBR	0	3.5	53	464	25.90	4.47	0.168	6.00	6.60
2095	0-10	BR	0	3.5	47	458	11.40	2.23	0.084	5.70	6.70
2858	0-10	GR	0	3.5	53	486	12.80	4.12	0.155	6.40	7.20
3350	0-10	BRGR	0	3.5	18	180	9.69	2.40	0.115	4.50	5.30

Table 1: Basic nutrient results (0-10cm) from CSBP did not highlight any major concerns

Sample ID	Depth	Coarse sand %	Fine Sand %	Sand %	Silt %	Clay %	Texture %	%>2mm	Comments
250	A	22.3	23.0	45.3	4.1	50.6	Clay	0.4	A1 0-15 heavy loam A2: 15-40 white sandy clay C: 55+ white sandy clay
250	B	49.3	8.8	58.1	1.0	40.9	Sandy Clay	3.1	
337	A	13.9	25.6	39.5	7.1	53.4	Clay	0.0	No data available
337	B	5.4	22.8	28.2	15.9	55.9	Clay	0.0	
1327	A	7.6	15.3	22.9	10.3	66.8	Clay	4.8	
1327	B	32.8	13.6	46.4	11.8	41.8	Clay	13.1	A1: 0-10 A2: 10-30 B: 30-60 massive 50-60 blocky C: 70+ sandy
2095	A	19.4	41.5	60.9	12.6	26.6	Clay Loam	14.0	
2095	B	4.4	9.3	13.7	21.3	65.0	Clay	1.6	A: 0-20 loamy B: 20+ grey clay
2858	A	16.9	31.2	48.2	5.7	46.2	Clay	6.7	
2858	B	24.6	13.8	38.4	7.6	54.0	Clay	28.2	A1: 0-15 A2: 15-40 B: 40-55 yellow clay C: 55+ white
3350	A	26.2	26.7	52.9	6.6	40.5	Clay	61.8	
3350	B	13.4	13.4	26.8	0.7	72.5	Clay	13.1	A: 0-15 gravelly B: 15-50 gravelly clay C: 50+ yellow clay

Table 2: Soil cores profile descriptions (0-100cm) showing significant textural differences

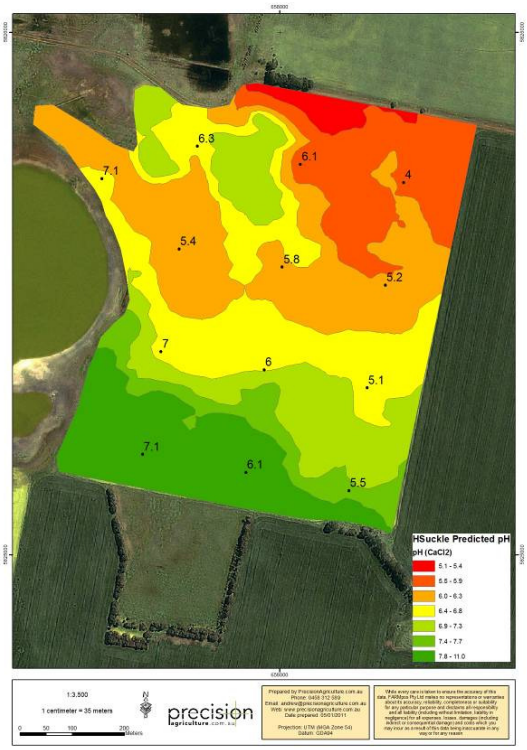
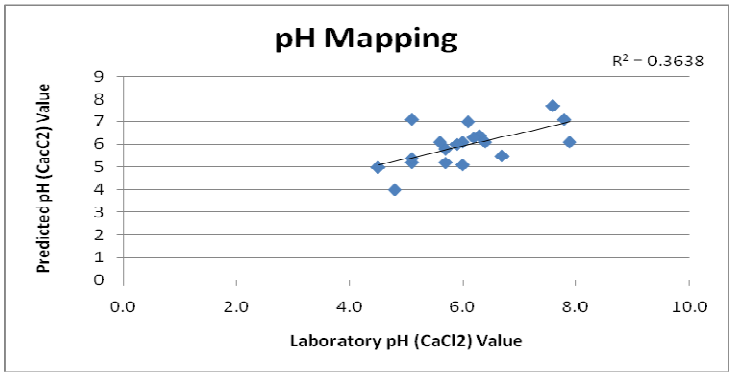


Image 2: Predicted pH (CaCl2) map created from 6 strategic soil samples and the EM-38 map versus the CSBP laboratory results



Graph 1: Comparison of predicted pH (CaCl2) versus laboratory measured pH suggested a relatively poor correlation with an R^2 of 0.36

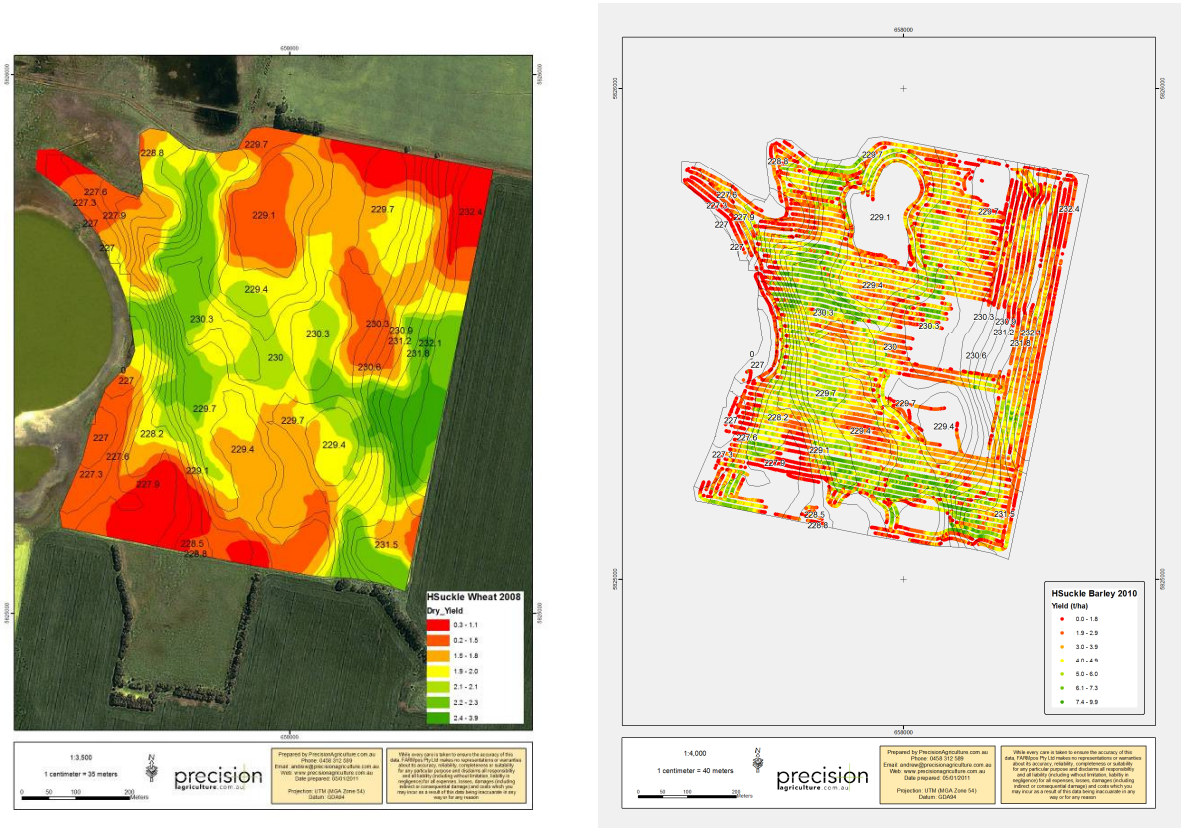


Image 4: 2008 canola yield (left) & 2010 barley yield (right) both with 30cm contour lines – areas of the 2010 yield map are missing due to being too wet to harvest

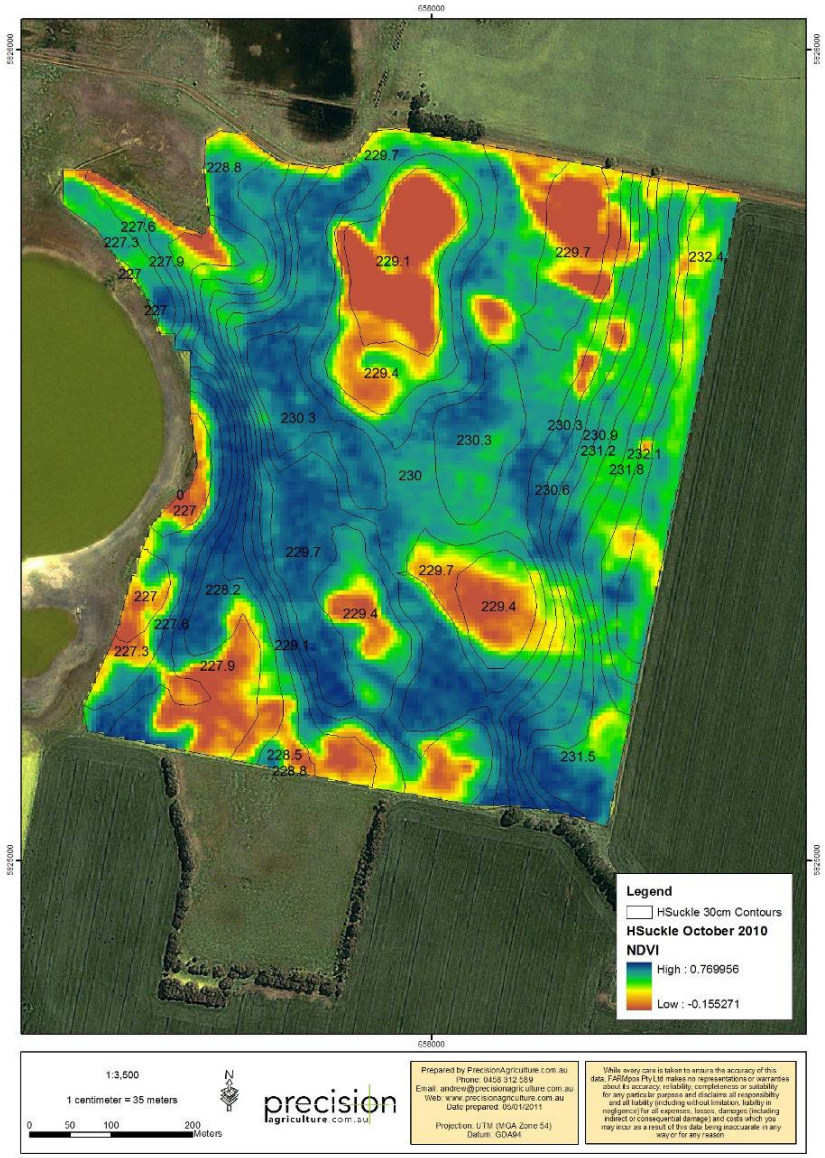


Image 5: October 2010 satellite image (5m pixel NDVI) clearly indicating water-logging effects

This satellite imagery (NDVI) has proven to be a fantastic tool for mapping extents of water logging and determining crop management zones. The ability to add contour maps to an NDVI map has once again proved to be one the most important layers of spatial information for site specific crop management.

This imagery will be used to assist the development of phosphorus application maps for the 2011 season. The aim is to reduce the P rates in areas where crop loss was experienced in 2010 – the reasoning behind this approach is that the crop did not remove as much P from the soil and there is a high risk that these areas will be affected by water logging in season 2011.

Who was involved?

Cooperating farmer: Neil Vallance
Trials coordinator: Andrew Whitlock (PrecisionAgriculture.com.au)
FSG contact: Karen Haigh (Southern Farming Systems)

Martin Peters (FarmingIT) assisted with EM-38 & elevation mapping, and collection/analysis of strategic soil cores (0-100cm)

CSBP soil laboratory for pH and nutrient testing

Andrew Whitlock (PrecisionAgriculture.com.au) managed all spatial data

Grower/Regional feedback:

Neil Vallance is actively moving down the path of variable rate management. The project paddock was one of several paddocks where Neil has conducted pH mapping and implemented fertiliser trials to test responses across proposed management zones.

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For more information

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